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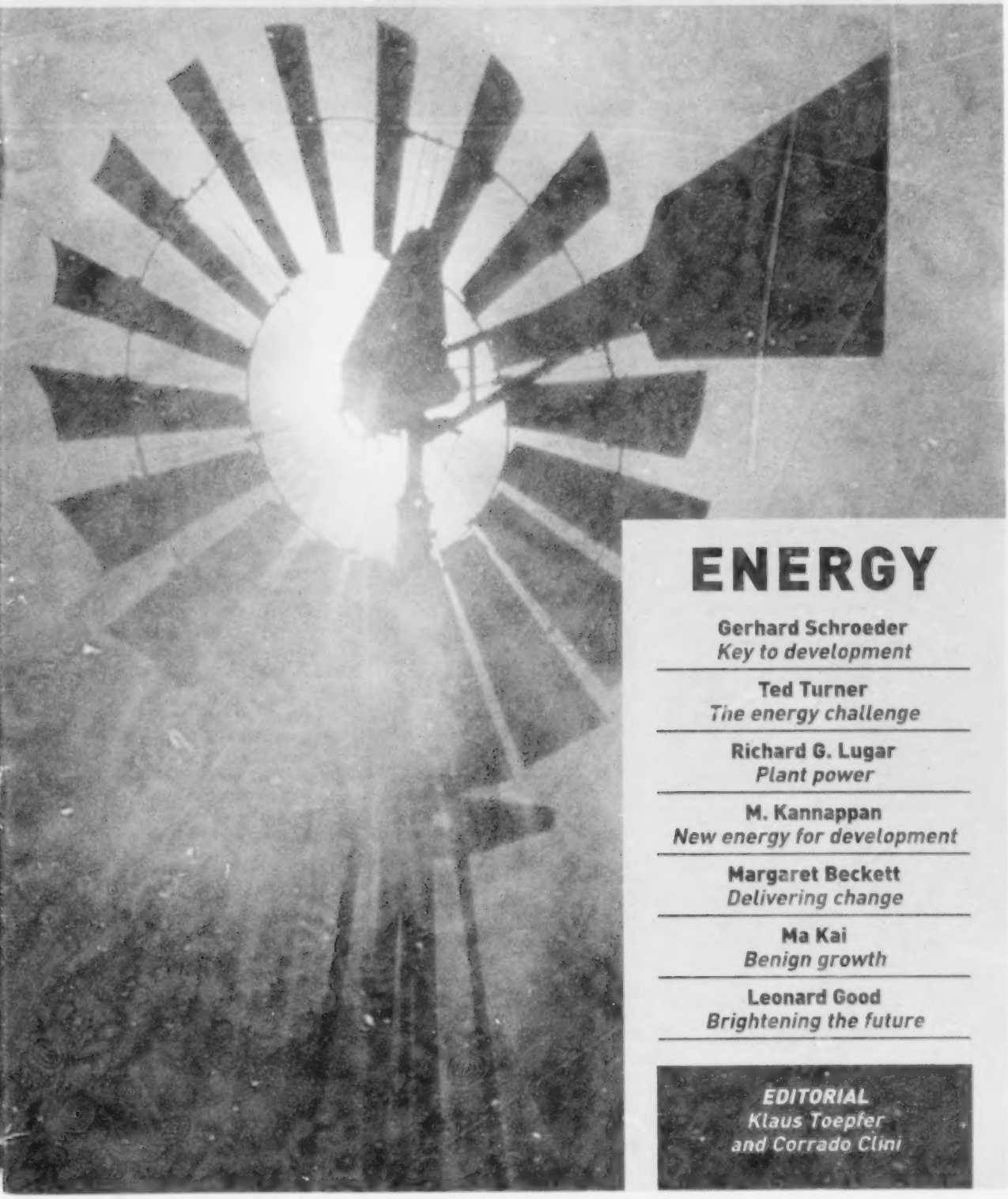

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EDITORIAL

From the desks of

KLAUS TOEPFER
United Nations Under-Secretary-General and Executive Director, UNEP

and **CORRADO CLINI**
Director General of the Italian Ministry of Environment and former co-Chair of the G8 Task Force on Renewable Energy

As delegates gather in Milan for the next round of climate change negotiations, some may wonder why such an event is necessary when the Kyoto Protocol, the international instrument for combating global warming, is not yet in force.

Surely, they will say, we can achieve little of substance until 55 countries representing 55 per cent of the emissions of the industrialized world have ratified it.

Such doubters should step outside the cocoon of gloom and smell the flowers.

In Italy – which hosts this ninth session of the Conference of the Parties (COP9) to the United Nations Framework Convention on Climate Change – for example, energy producers have been obliged to deliver a fixed amount of renewable energy into the national grid since 1999. A national plan for increasing wind and biomass-based energy generation has been established: its fruits include new 800 megawatt capacity for wind, and 10 megawatts from biomass in Maratta Bassa, Umbria.

New laws, economic incentives and the fast tracking of projects – both nationally inspired and as part of European Union initiatives – have helped improve the prospects for cleaner energy.

Power companies and banks are actively involved, proving yet again that saving the planet is a profitable business which generates jobs.

Next year Germany will host the International Conference on Renewable Energies. Last October the United Kingdom launched its Renewable Energy and Energy Efficiency Partnership (REEEP) and in November Italy launched the Mediterranean Renewable Energy Partnership on the occasion of the Conference of the Parties to the Barcelona Convention. These are ideas that were born out of the World Summit on Sustainable Development (WSSD) in Johannesburg last year and modelled on recommendations made earlier by the G8 Renewable Energy Task Force.

Among early success stories are the installation of solar power in Brazil, India and Sri Lanka through partnerships including BP Solar and Shell Renewables.

REEEP may be the latest initiative of its kind, but it is by no means the first – or the last. Last year the Global Network on Energy for Sustainable Development – involving specialized centres in India, Argentina, Senegal, Kenya and other countries – was launched at Johannesburg.

UNEP and the UN Foundation – whose sister body, the Better World Fund, has generously supported this issue of *Our Planet* – have been developing the Rural Energy Enterprise Development (REED) programme. It has three spin-offs: AREED, in Africa; CREED, in China; and B-REED focused on the Bahia and Alagoas areas of north-east Brazil. Other supporters include the Fund for International Partnerships, E+Co, the Blue Moon Fund, The Nature Conservancy and UNEP's collaborative Riso centre in Denmark.

REED aims to establish networks of clean energy entrepreneurs and businesses in developing countries. AREED, for example, has invested in 15 clean energy enterprises, supporting projects including the manufacturing of efficient cooking stoves, solar water-heating systems, wind-powered pumping and improved distribution of liquefied petroleum gas.

Access to energy is essential if the United Nations Millennium Development Goals and the WSSD Plan of Implementation are to be achieved, and the proportion of the world's people in poverty is to be halved by 2015.

Some 3 billion people rely on dung, coal, charcoal and kerosene for cooking and heating. Inefficient use of these fuels contributes to indoor and local air pollution, linked to up to 5 per cent of global disease.

The Global Environment Facility is backing an assessment of the solar and wind potential of developing countries. And the Sustainable Energy Finance Initiative (SEFI), launched only a few weeks ago at a UNEP Finance Initiative meeting in Tokyo, Japan, will complement attempts to overcome financial barriers to a rapid, widespread uptake of clean energy systems.

These are just some projects, partnerships and initiatives. Others are underway in the United States, Japan and elsewhere. Clearly not all will be successful. Some may wither and die. But many different kinds of flowers are needed to make a beautiful bouquet, and so many are now blossoming that there is the real promise of a less carbon intensive future.

In Milan we must water this garden so that the initiatives so actively backed by many countries, companies and communities can be growing strongly when the Kyoto Protocol finally enters into force ■

UNEP

COP9

YOUR VIEWS

We would really like to receive your feedback on the issues raised in this edition of ***Our Planet****. Please either e-mail feedback@ourplanet.com or write to:*
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KEY TO *development*

GERHARD SCHROEDER says that sustainable energy supplies are essential to combat poverty, prevent crises and conflicts and safeguard natural resources

Around a third of the world's population lacks adequate access to energy supplies. Improving this situation provides one of the major challenges for future-oriented policy at the start of the 21st century. Germany is participating in efforts to facilitate sustainable energy supplies all over the world. We expressed this in particular at the Johannesburg World Summit in September 2002 by announcing concrete programmes, which sent out a strong signal to the international community. Sustainable energy supplies are essential to combat poverty, to prevent crises and conflicts and to safeguard natural resources.

Yet, we are still a long way from achieving this goal. The quarter of the world's population that lives in the northern industrialized countries accounts for three quarters of the global consumption of resources. At the same time, these countries are the source of three quarters of all carbon dioxide (CO_2) emissions – with their effects on the global climate. In the next decades there is also expected to be a steep rise in energy consumption in the developing countries. Energy efficiency levels in those countries – as well as in some industrialized countries – are low. This is another reason for the rapidly growing danger posed to the global climate by CO_2 emissions. To put it simply, sustainable energy supplies can only mean one thing: improving energy efficiency combined with renewable energy use.

Therefore, developing and industrialized countries bear joint responsibility. The industrialized countries must adopt new approaches in industry and society in the pursuit of energy conservation, energy efficiency and renewable energies. For their part, the developing countries must be given the opportunity to develop a sustainable future for themselves to free them from long-term dependence on less sustainable energy forms. It was for such reasons that the states participating at the Johannesburg Summit agreed that the fights against poverty and for access to sustainable energy must go hand in hand. The European Union and several additional countries joined together in a group of like-minded countries to commit themselves to timetables and targets for increasing the use of renewable energies.

Strategic partnership

The Federal Government of Germany also announced in Johannesburg that it would turn its cooperation with developing countries into a strategic partnership under a programme of Sustainable Energy for Development. Over the next five years a total of €1 billion (approximately $1.17 billion) will be made available for this purpose – 500 million for renewable energies and 500 million for improving energy efficiency. In providing this money we will be helping the developing countries to make energy more efficient and climate friendly.

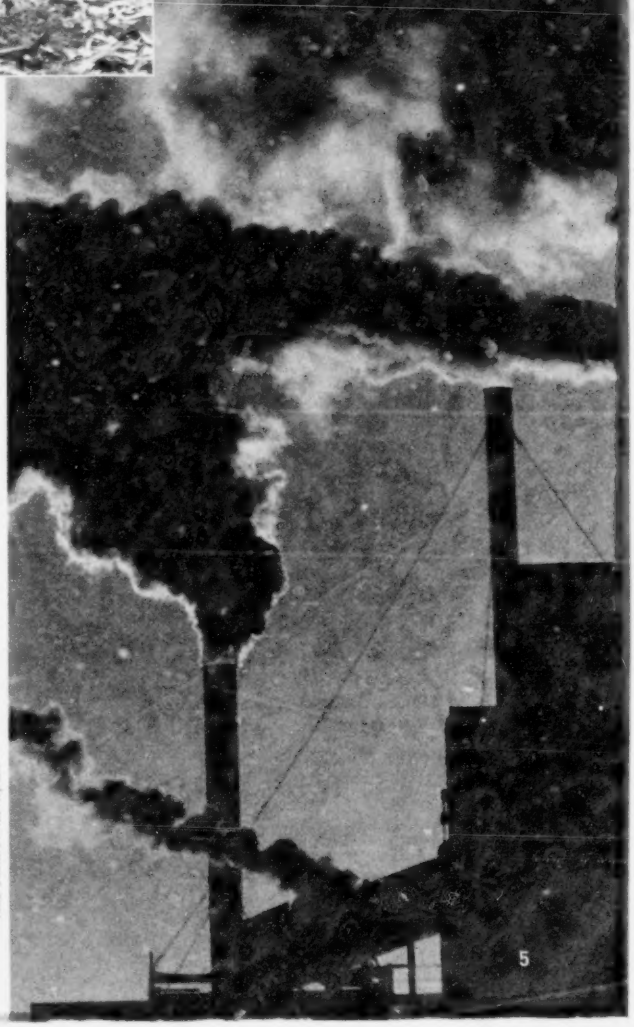
For example, a project financed by Germany is promoting the development of energy consulting, the introduction of energy audits and the use of energy-saving technologies in India. There, electricity is both in short supply and expensive. Energy-intensive production methods only drive up company costs. By introducing more efficient processes, industry and small businesses could save 15 to 20 per cent of their energy costs. As for the impact on climate change, it would mean 15 million fewer tonnes of CO_2 emissions each year. Several demonstration plants are showing how effective such measures are and how energy conservation not only helps protect our climate but also increases competitiveness.

Support for renewable energies

I have issued an invitation to an international conference on renewable energies to be held in Bonn in June 2004. 'Renewables 2004' will focus on strategies and measures to provide active support for renewable energies, removing barriers to the expansion of renewable energies and developing markets for them around the world. The conference aspires to commitments to national and regional targets, the adoption of an international action plan and the drawing up of guidelines for good policies in the energy sector. I am hopeful that the conference will stimulate a new dynamism in the worldwide development and expansion of renewable energies.

Sustainable energy supplies are a long-term goal. Germany is playing its part to that end. Today, we are already leading the industrialized countries in terms of energy efficiency, but we have set ourselves still higher standards in our national sustainability strategy. By 2020 we intend to double our energy productivity levels of 1990.

Heather Johnston/UNEP Topham



Tim J. Johnson / UNEP Topham

Developing and industrialized countries bear joint responsibility ... the fights against poverty and for access to sustainable energy must go hand in hand

Germany is also making good progress in the expansion of renewable energy. Wind energy is playing a major role in this. Indeed, one third of the world's wind power is now generated in Germany. Accordingly the economic significance has increased: around 130,000 people are employed in the renewable energies sector here, especially in small and medium-sized businesses. The goal of the Federal Government is to raise the proportion of renewable energy used in power generation to 12.5 per cent by 2010, thus doubling the share it had in 2000.

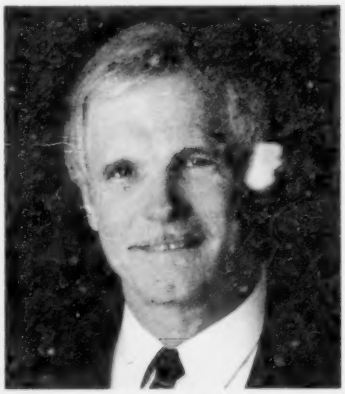
Sustainable prosperity

In this way, we are developing a model of growth and prosperity that is sustainable because it is not at the expense of the environment, future generations or the developing countries. Because we cannot call on the developing countries to make careful use of the resources that they have at their disposal if we, the richest countries in the world, are not prepared to contribute the groundwork. It must be our common goal that successful economic development and the reduction of poverty can be combined with the protection of natural resources, in the developing countries as well as the industrialized ones ■

Gerhard Schroeder is Chancellor of the Federal Republic of Germany.

The energy challenge

TED TURNER describes the imperatives of tackling energy poverty and climate change – and work done by the UN Foundation to address them



UNF

The responsible course ... is to get moving in the right direction

Balancing the world's growing need for energy against our collective need for a healthy environment in many ways lies at the heart of the development challenge. Globally, fossil fuels account for nearly 60 per cent of the emissions that are causing the Earth's atmospheric blanket of carbon dioxide to thicken and trap more heat. In the United States, fossil fuels contribute an even larger share – 85 per cent – of these emissions.

Of all the threats to the world's environment, the prospect of climate change looms largest. There is almost complete consensus in the scientific community that our climate is changing and warming; the remaining uncertainty is about how fast and how much this will impact the globe.

The responsible course in the face of these truths – in the face of risks that large – is to get moving in the right direction. Increased energy efficiency and increased use of renewable energy are tools to reduce carbon emissions that are readily available today, and their use would grow with economic incentives.

Energy and human development

Of the world's 6 billion people, one third enjoy the kind of 'energy on demand' that North Americans take for granted, and another third have such energy services intermittently. The final third – 2 billion people – simply lack access to modern energy services. Not coincidentally, the energy-deprived are the world's most impoverished, living on less than $2 per day. Their ranks will continue to grow. According to UN estimates, the populations of the 50 poorest nations will triple in size over the next 50 years. Without access to modern, reliable energy sources, social and economic development is not possible.

A number of new models have helped demonstrate, on a limited scale, various approaches for financing and delivering affordable rural energy services. Our challenge is to build on these successes and continue to increase their impact by scaling up programmes that work and encourage the flow of private capital into sustainable energy development.

UN Foundation role

To date, the UN Foundation has invested more than $28 million in United Nations projects working to address the energy challenge. One of our flagship projects, African Rural Energy Enterprise Development (AREED), seeks to develop new sustainable energy enterprises that use clean, efficient and renewable energy technologies to meet the energy needs of under-served populations, while reducing the environmental and health consequences of existing energy use patterns.

The AREED approach offers rural energy entrepreneurs a combination of enterprise development services and start-up financing. This integrated financial and technical support allows entrepreneurs to plan and structure their companies in a manner that prepares them for growth and makes eventual investments by mainstream financial partners less risky.

In Mali, where firewood and charcoal represent more than 90 per cent of the country's household energy consumption, AREED is working with a local business to develop alternative cooking fuels to decrease the dependence on traditional sources which causes forest degradation and desertification and contributes to overall poverty. The local company is addressing this need by manufacturing briquettes from agricultural by-products, such as coconut husks, hulls of groundnut, sawdust and rice husks. AREED is assisting the company with a market study and strategy that will allow it to market its product more effectively and prepare the company for business expansion.

AREED has been so successful that the UN Foundation has expanded its support to include similar activities in Brazil and China ■

Ted Turner is Chairman of the United Nations Foundation.

Photo: UNEP/Topham

Plant POWER

RICHARD G. LUGAR calls for a new green revolution to combat global warming and reduce world instability

In a world confronted by global terrorism, turmoil in the Middle East, burgeoning nuclear threats and other crises, it is easy to lose sight of the long-range challenges. But we do so at our peril. One of the most daunting of them is meeting the world's need for food and energy in this century. At stake is not only preventing starvation and saving the environment, but also world peace and security. History tells us that states may go to war over access to resources, and that poverty and famine have often bred fanaticism and terrorism. Working to feed the world will minimize factors that contribute to global instability and the proliferation of weapons of mass destruction.

With the world population expected to grow from 6 billion people today to 9 billion by mid-century, the demand for affordable food will increase well beyond current international production levels. People in rapidly developing nations will have the means greatly to improve their standard of living and caloric intake. Inevitably, that means eating more meat. This will raise demand for feed grain at the same time that the growing world population will need vastly more basic food to eat.

Complicating a solution to this problem is a dynamic that must be better understood in the West: developing countries often use limited arable land to expand cities to house their growing populations. As good land disappears, people destroy timber resources and even rainforests as they try to create more arable land to feed themselves. The long-term environmental consequences could be disastrous for the entire globe.

Richard G. Lugar

Richard G. Lugar inspecting corn on his US farm.

Agriculture and the wider sphere of plants represent a resource not only for food, but also for the fuel, energy and materials essential to modern society

Productivity revolution

To meet the expected demand for food over the next 50 years, we in the United States will have to grow roughly three times more food on the land we have. That's a tall order. My farm in Marion County, Indiana, for example, yields on average 8.3 to 8.6 tonnes of corn per hectare – typical for a farm in central Indiana. To triple our production by 2050, we will have to produce an annual average of 25 tonnes per hectare.

Can we possibly boost output that much? Well, it's been done before. Advances in the use of fertilizer and water, improved machinery and better tilling techniques combined to generate a threefold increase in yields since 1935 – on our farm back then, my dad produced 2.8 to 3 tonnes per hectare. Much US agriculture has seen similar increases.

But of course there is no guarantee that we can achieve those results again. Given the urgency of expanding food production to meet world demand, we must invest much more in scientific research and target that money toward projects that promise to have significant national and global impact. For the United States, that will mean a major shift in the way we conduct and fund agricultural science. Fundamental research will generate the innovations that will be necessary to feed the world.

The United States can take a leading position in a productivity revolution. And our success at increasing food production may play a decisive humanitarian role in the survival of billions of people and the health of our planet.

Directly related to our challenge to feed a growing world is the necessity of providing a sustainable resource for fuels, chemicals and materials. I believe that agriculture and the wider sphere of plants represent a resource not only for food, but also for the fuel, energy and materials essential to modern society. Scientists have developed biotechnologies – genetically engineered yeasts, enzymes and bacteria – capable of breaking down plants, trees, grasses and agricultural residues (known as biomass) into their constituent chemical building blocks, principally in the form of complex sugars. From this intermediate step, we can produce a wide variety of bio-based products including animal feed, chemicals and – importantly – fuel.

If a significant percentage of products currently derived from petroleum can be produced from biomass, the major industrial economies will improve their strategic security by ▶

reducing their dependence on Middle Eastern oil and all countries, rich and poor, can spend far less on oil imports, dramatically reduce greenhouse gas emissions and help strengthen their own rural communities while simultaneously building a new bio-based industry worth hundreds of billions of dollars worldwide per year.

Shift to bio-based fuels

Bio-based fuels such as ethanol have clear potential to be sustainable, low cost and high performance, are compatible with both current and future transportation systems, and provide near-zero net greenhouse gas emissions. The impact of bio-ethanol on greenhouse gas emissions is particularly significant because the transportation sector relies almost exclusively on fossil fuels and accounts for one third of total greenhouse gas emissions. A shift to bio-based fuels is a long-term approach to the problem of global warming that does not require a shift from automobiles or result in increased costs for US employers and consumers.

As my friend, former CIA director James Woolsey, who has worked with me on this issue, likes to say, this is not your father's ethanol. We currently derive ethanol from corn and other starches, an energy-intensive process that results in an expensive product. He notes that using biocatalysts, or other technologies nearing commercialization like thermal depolymerization, we can cut costs by orders of magnitude, making bio-ethanol competitive with gasoline even if the price of oil drops to $10-13 a barrel. Equally important, large-scale production won't require us to plough up marginal land or displace food crops.

Before we can reap these benefits from the sustainable

Jacky Sewadha/UNEP/Topham

Romain/UNEP/Topham

Natalia C. Mazzucchelli/UNEP/Topham

Bioenergy: *doing well while doing right*

TIMOTHY E. WIRTH, C. BOYDEN GRAY and **JOHN D. PODESTA** describe the great potential for energy security and the environment in growing one's own fuel

Agricultural trade barriers remain one of the most stubborn and persistent obstacles to a truly open and fair global trading system. Despite high-minded rhetoric about the benefits of free-market principles, Western countries have resisted the removal of the $300 billion a year in subsidies that long have tilted the system in their favour. These subsidies promote market inefficiencies and cripple the ability of some of the poorest nations on Earth to compete, even in their own markets.

These policies are not just inefficient and contrary to our stated beliefs in free and fair trade; they are also a cruel obstacle to progress for farmers in other lands who are struggling to make a living. Dairy cows in Europe and Japan receive more each day in government subsidies than the rural poor are able to earn in the developing world.

Technical advances in the science of bioenergy – the conversion of agricultural wastes and other organic material to fuels and other products – offer a way out of this seemingly intractable conflict and could have surprising payoffs in other areas as well: economic growth in the developing world, reductions in the emission of greenhouse gases, and easing the world's dangerous dependence on oil.

Multiple benefits

Bioenergy – growing one's own fuel – offers the opportunity to do well while doing right. For several decades, the United States has promoted development of ethanol because it offers multiple national benefits – aiding farmers, the environment and the nation's energy security. But we have only scratched the surface of bioenergy's promise.

Most ethanol is produced from corn, using only the starch in the kernels. But new conversion technologies could lead to the cost-effective use of a wide variety of feedstocks and agricultural waste pro-

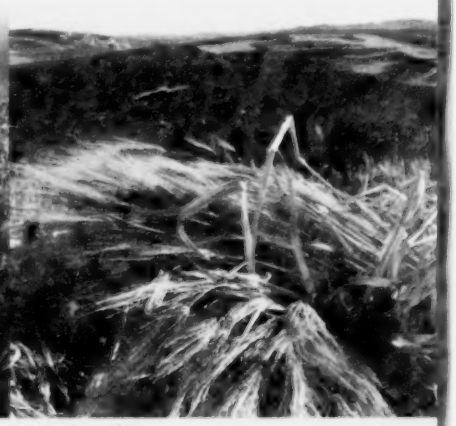
biomass resource, the cost of the new technology must be slashed. Again, research offers the only systematic means for creating the innovations and technical improvements that will bring down biomass processing costs. Given the private sector's short-term horizon, and because many benefits of biomass processing are in the public interest, governments and multilateral institutions should take the lead in this important effort and invest in the promise of a new green revolution.

Remarkable opportunity

From the days when I worked on our farm as a boy through my time in the United States Senate, where I have always served on the Senate Agriculture Committee, I have witnessed tremendous change in the way we farm in the United States and around the world. Although we are faced with enormous challenges for the future, at no time has agriculture been as exciting and full of opportunity as it is today. Pessimists may say that humanity has got itself into a hopeless muddle, but I have faith in the limitless supply of human ingenuity. We would be extremely shortsighted not to take advantage of the scientific breakthroughs that have occurred in agriculture and biomass conversion. If we do, we will make life far less dangerous and far more prosperous for future generations. If we do not, those generations will look back in angry wonder at the remarkable opportunity that we missed ■

Richard G. Lugar, a US Senator from Indiana, is Chairman of the Senate Foreign Relations Committee, and a member and former chairman of the Senate Agriculture Committee.

Romain/UNEP/Topham



Jacky Sawalha/UNEP/Topham

ducts like corn stalks and wheat straw to produce ethanol and other products, such as chemicals and plastics, that are currently derived from fossil fuels. These technologies allow farmers to harvest double dividends – selling cash crops like corn and wheat, and converting the leftover 'waste' to fuel for the transportation sector.

Bioenergy's potential is huge – economically and environmentally. Currently, ethanol accounts for less than 2 per cent of US gas consumption. The new bioenergy technologies could dramatically increase that figure, producing as much as 150 billion litres – the equivalent of one quarter of our current gasoline use. Bioenergy will also help prevent further global warming because the carbon dioxide emitted as it is produced and used is absorbed by the plants as they grow. The net greenhouse gas emissions are near zero.

Moreover, bioenergy could spur economic development around the world. Advanced ethanol technologies will provide poor countries with a new way to meet transportation needs that are necessary prerequisites to economic progress and growth. With the right technology and basic training, these countries will be able to grow their own fuels, allowing them to redirect scarce foreign exchange earnings away from imported oil to more productive national investments – including critical social investments in health, education and welfare.

Productive subsidies

The West is unlikely to abandon agricultural subsidies – but it can direct them in a much more productive and less destructive manner. By shifting subsidies from food crops to bioenergy production, the United States and others can support farm income, reduce oil dependence and

Bioenergy's potential is huge – economically and environmentally

make environmental progress, both at home and abroad.

With gasoline prices reaching all-time highs in many areas, climate change threatening the stability of the world's ecosystem and the dangers of persistent global poverty increasingly clear, industrialized nations should lead the world toward the rapid development of clean, abundant biofuels ■

Timothy E. Wirth is President of the United Nations Foundation. C. Boyden Gray, a partner at Wilmer, Cutler & Pickering, was Counsel to former President George H.W. Bush; and John D. Podesta, President of the Center for American Progress, was Chief of Staff to former President Bill Clinton.

New energy *for development*

M. KANNAPPAN describes India's programme to bring renewable sources of energy to its villages and to become a world leader in the new technologies

The Indian energy mix is a combination of commercial and traditional sources. Thirty per cent of energy needs are met through traditional renewable sources such as biomass and animal waste. More than 65 per cent of the population which does not have access to modern energy services is dependent on biomass, animal waste and kerosene for cooking and lighting. In 2001-2002, the consumption of traditional fuels was estimated at 140 million tonnes of oil equivalent. Projections indicate that in 2011-2012 their share will come down by 3 percentage points to 27 per cent.

During the last two decades India's renewable energy programmes have grown in volume, technological maturity and reach. Initially, the thrust of the national effort was directed towards capacity building and research and development, mostly in national laboratories and educational institutions. However, major expansion was witnessed in activities from the 1980s onwards, focusing on large-scale demonstration and subsidy-driven extension activities mainly in providing energy services to rural areas through biogas, improved cooking stoves and solar energy. These programmes created awareness, generated field experience, and helped set up a vast network of institutions and non-governmental organizations reaching right down to self-employed workers at the grassroots level. The emphasis is currently on commercialization – with private sector participation in power generation from wind, small hydro and biomass combustion/gasification, as well as in industrial applications of solar and other forms of renewable energy.

Reaching millions

Wind, biomass and small hydropower contribute about 3.5 per cent of the installed capacity for electric power. Against an estimated renewable energy potential of about 80,000 megawatts from commercially exploitable sources, more than 4,000 megawatts has been harnessed to date. Biogas and solar lighting systems have reached 3.5 million and 1 million households respectively. Many technologies are currently at the threshold of economic viability. A modest manufacturing capacity has been set up in the country, and institutional mechanisms developed to support the deployment of renewable energy technologies.

The spread of these various renewable energy technologies in India has so far been aided by a mix of policy and support measures. Incentives available include soft loans, concessional rates of customs duty, exemption from excise duty and sales tax, and 80 per cent accelerated depreciation benefit to commercial projects. Subsidies are available in some programmes – especially those deployed in rural areas, such as improved woodstoves, biogas plants, solar lanterns and home lighting systems.

India faces a major challenge of providing energy to more than 600,000 human settlements spread over 300,000 square kilometres – with a population of 1 billion which is still growing and expected to stabilize at around 1.6 billion during the next 40 to 50 years or so. The task is severely compounded by low living standards, with around 75 per cent of the population below a per capita per day international poverty line of $2 at purchasing power parity (PPP) rates. Their low purchasing power has resulted in low levels of per capita energy and electricity consumption.

In this context the major national aims are:

- providing reliable energy supply through a diverse and sustainable fuel mix that addresses security concerns;
- the speedy commercial exploitation of renewable power potential;
- the eradication and removal of energy poverty across the country;
- ensuring availability and affordability of energy supply, including safety aspects related to it;
- electrification of all households in remote villages by 2012;
- electrification of around 18,000 remote villages through renewables by 2007 (those that are not likely to be connected to the grid by 2012);
- 10 per cent power capacity addition through renewables by 2012;
- 3 million family-type biogas plants and 7 million solar lighting systems by 2012.

We in India recognize that efficient management of energy is essential in achieving the goals of sustainable development

S.K. Patel/UNEP/Topham

India is also looking forward to becoming a global leader in new and renewable energy technologies. Its efforts promoting renewable energy are in harmony with global concerns.

At present the global interest in renewable energy is mainly on account of climate change. The global concerns can be articulated as the need to:

- cap global CO_2 emission levels by around 60 per cent by 2050 to arrest the process of global climate change;
- cap and roll back higher levels of fossil fuel consumption: liquid hydrocarbons would otherwise become beyond the reach of many;
- work towards lowering the relative price of new and renewable power technologies through a continuous and focused research and development effort;
- improve access to reliable, affordable, economically viable, socially acceptable and environmentally sound energy services and resources.

These global concerns are expected to lead to the ushering in of what has been termed a carbon-free economy which is expected to be based on a fuel mix mainly provided by the green or renewable energy technologies.

The key to realizing the full potential of renewables is accepted to be the development and deployment of both new and existing technologies. We have been tracking technological developments and have initiated research and development in some frontier areas. Our perception is that the future energy technological scenario would be:

- more diverse than today;
- a versatile fuel mix, on account of new and emerging technologies including CO_2 capture and storage;
- local generation through biomass/wind/hydro etc;
- micro-generation through new innovative end-use packages from fuel cells, solar photovoltaics, etc.

However, the underlying objective, while progressing on this road map, has to be that new and renewable energy technologies are accessible, affordable, reliable and safe for utilization.

Meeting energy goals

We in India recognize that efficient management of energy is essential in achieving the goals of sustainable development. We consider new and renewable energy development and deployment to be of great importance for long-term energy supply security, decentralization of energy supply (particularly for the benefit of the rural population), and environmental benefits and sustainability. In this context, the Indian renewable energy programme can be said to be a goal-oriented effort to meet the country's energy requirements in an environmentally sound way ■

M. Kannappan is the Minister of Non-Conventional Energy Sources, India.

Indrajit Sarkar/UNEP Topham

R. Rasoo Babu/UNEP Topham

Sanghee B. Moon/UNEP Topham

Yoon Seung/UNEP Topham

PEOPLE

Government of China

Xie Zhenhua – the initiator, leader and implementer of China's environmental protection programme – and **Dener Giovanini**, who has created a successful network against wild animal trafficking in Brazil, share the 2003 UNEP Sasakawa Environment Prize. Mr Xie, who now holds the post of Minister, State Environmental Protection Administration of China, has been working in the field for more than two decades, bringing about significant improvements in his country. He initiated a water treatment campaign that brought safe and clean drinking water to 200 million people. He guided the phase-out of polluting and wasteful processes, equipment and products at over 100,000 medium and small-sized enterprises and developed low-pollution or no-pollution industries in their place, finding solutions for laid-off workers.

Under his leadership, 1,757 nature reserves – covering 13.5 per cent of the area of China – have been created. He has encouraged the growth of environmental non-governmental organizations, and of media coverage of the area. He has succeeded in persuading Government authorities to reroute key infrastructure projects to avoid sensitive sites. And he has brought about his country's implementation of the Montreal Protocol, under which China has accounted for half the phase-out of ozone-depleting substances across the developing world. Over the past seven years China's GDP has grown by 8 per cent annually, but the total discharge of the main pollutants has declined every year.

Dener Giovanini

Mr Giovanini created the National Network for Combating Wild Animal Trafficking in 1999 to curb, and ultimately stop, an illegal trade worth $1.5 billion a year in Brazil. In just four years he has put in place an effective, multi-pronged and rapidly expanding network in a country which has anti-trafficking laws but lacks the infrastructure to address the problem systematically. Some 1,600 police and Government agents have been trained, and police and customs officials have been linked with a network of 234 volunteer veterinarians. The network has also found alternative work for poor people engaged in the trade, by teaching them how to tend wild animals and construct appropriate habitats for them ■

Pascal Flais-Information Rwanda

Two outstanding internationalists, and friends of UNEP, have died tragically: **Anna Lindh**, the Swedish Foreign Minister, who was murdered in Stockholm; and **Sergio Vieira de Mello**, the United Nations envoy in Iraq, who was killed in the car bomb attack on the UN offices in Baghdad. They were two of the world's most capable and inspirational public figures.

Anna Lindh entered the Swedish cabinet as Minister of the Environment in 1994 and served in that post for four years. She was known for her honesty and negotiating skills and inspired trust on all sides. A message pinned to a single red rose outside the hospital where she died said: 'You were proof that an ordinary hard-working girl could take on the world.'

Sergio Vieira de Mello, the High Commissioner for Human Rights who was on secondment to Iraq for a four-month assignment, had unparalleled experience of handling difficult situations: he had successfully been both the special envoy in Kosovo after the war and Interim Administrator of East Timor after the withdrawal of Indonesia. He was steadily building trust in Iraq before his death.

UN DPI Photo

Kofi Annan, the UN Secretary-General said of Vieira de Mello: 'I can think of no-one we could less afford to spare or who would be more acutely missed.' Millions of Swedes, and many millions more around the world, will feel the same about Lindh ■

UNEP *is launching a new international environmental award which each year will recognize six* ***Champions of the Earth,*** *one from each region of the world. The champions will be rewarded for their creativity, vision and leadership – and for the potential of their work and ideas for replication worldwide. See www.unep.org/champions* ■

Delivering CHANGE

MARGARET BECKETT outlines a new initiative to break down barriers to increasing energy efficiency and the use of renewables

A low-carbon economy is attainable. All countries need to have the serious intention to move towards it and thus enhance our collective energy security.

We in the United Kingdom have already taken a major step. In February 2003 we published our Energy White Paper – the United Kingdom's first comprehensive forward-looking statement of energy policy in over 20 years, acknowledging the fundamental interdependence of economic growth, social progress and environmental objectives. A long-term strategy, its key aim is a 60 per cent cut in carbon dioxide emissions by about 2050.

But a global low-carbon economy will not be realized just because the United Kingdom and some like-minded countries wish it. Global participation is essential and governments cannot deliver it alone. Policy makers, business and civil society need to work closely together to deliver the changes we need.

Last year at the Johannesburg World Summit on Sustainable Development, I launched the idea of the Renewable Energy and Energy Efficiency Partnership, (REEEP), founded by a group of governments, businesses and non-governmental organizations who felt that partnership was crucial to delivering the sustainable energy commitments we all agreed at the Summit.

I believe it to be a key vehicle for turning such commitments into positive outcomes, harnessing the best ideas from across the globe to achieve just this.

Reuters

Overcoming barriers

Efficient energy use will be essential. Through the REEEP, our experience and those of many other countries in implementing energy efficiency policies and programmes can benefit all. We in the United Kingdom very much look forward to learning from the experience of others.

We also need an urgent and substantial increase in the use of renewable energy sources. Through the REEEP we can work together to achieve this.

Barriers to the uptake of renewable and energy efficiency technologies remain: inappropriate policies, subsidies and structural arrangements; problems in accessing finance; and a lack of human and institutional capacity. Overcoming them requires concerted effort from governments, businesses, financial institutions and the rest of civil society. The REEEP can help channel this activity at a regional and a global level, ensuring that climate-friendly policies go hand in hand with economic growth, poverty reduction and respect for the varied needs of developing countries.

We need to deliver increased energy efficiency and use of renewable energy. More technological development and international cooperation can help. We need a global partnership of governments, businesses and other stakeholders working together to foster market growth in renewable and energy efficiency technologies and striving to remove policy, technical, market and regulatory barriers to it. Climate-friendly technologies can help create a competitive and sustainable economy, while showing that ambitious and long-term targets on climate change are achievable.

Partners in the REEEP will work in three main areas:

- Identifying and removing market barriers. These will be different depending on location, so the REEEP has an important regional dimension. A network of regulators – or a series of networks – is likely to be one of its early achievements.
- Helping to match finance with innovative renewable and energy efficiency projects. By facilitating links between business and other innovators, REEEP partners will promote sustainable energy projects at the national and regional level – such as the development of energy services markets, tradable renewable energy certificate schemes and the European Union carbon emissions trading scheme.
- Having an important communications role, promoting and explaining the benefits of renewable energy and energy efficiency to international organizations, governments, regulators, business and other key stakeholders.

Opening doors

As a global partnership, the REEEP offers an opportunity to influence the future direction of a new and expanding market and a unique access to key policy makers and regulators. It opens doors to new technology and the opportunity for innovations to be shared globally. It provides the chance to evaluate options against what has worked – and what has not – in different countries and regions.

It has already demonstrated its worth. A regional plan was drawn up at a recent REEEP partners meeting in Beijing to enable countries to work together to deliver energy efficiency and increase the use of renewable energy.

A global low-carbon economy is within our grasp. But we need to work together to achieve it, to reduce costs and share knowledge, experience and practice. The REEEP will play a vital role in helping us to get there ■

Margaret Beckett is Secretary of State for the Environment, Food and Rural Affairs, United Kingdom.

Benign growth

MA KAI describes how China is committed to a sustainable development energy strategy as it doubles consumption in less than two decades

Energy brings people light and promotes the development of civilization. But it also produces pollution on our planet, facing us with the challenge of how better to protect the environment.

There are great development prospects and vast commercial opportunities in China's energy growth. In 2002, the Chinese consumed the equivalent of 1.15 tonnes of standard coal and 1,292 kilowatt-hours of power per capita, lower than the world's average. By 2020, when China's per capita GDP reaches $3,000 a year, each of our people will be consuming almost twice as much energy, the equivalent of 2 tonnes of standard coal every 12 months, while the country's total consumption will have increased to the equivalent of 2.5 billion tonnes.

China is unswervingly adhering to a sustainable energy development strategy in the new millennium, minimizing energy consumption's impact on the environment while promoting energy development. It is:

- Promoting restructuring of the energy mix. The share of oil and natural gas in primary energy consumption will be increased and measures will be taken to raise the proportion of hydro, nuclear and wind power in China's electricity generation capacity from 25.6 per cent in 2000 to 36 per cent in 2020.

Green energy

LIU SHUYING describes a pioneering project to provide heat and power from waste corn stalks in rural China

Eleven years ago Hechengli, in the northeast corner of China, began planning to become an Ecological Village in Jilin Province. Now it is pioneering again, as host to a revolutionary new energy project which could prove a model for China and much of the developing world.

A combined heat and power plant, to be fuelled by corn stalks and other agricultural wastes, has been built on a hill overlooking the village of 224 households in one of the most fertile parts of the country. Financed jointly by the local Jilin Provincial Government and the United Nations Development Programme (UNDP), it is designed to produce cooking gas, heat and electricity simultaneously and to demonstrate the technical, economic and market viability of a modern biomass gasification system. The UNDP funds are being provided through a grant from the UN Foundation.

Jilin Province, home to just 2 per cent of China's population, produces 14 per cent of its corn. The corn stalks currently pose a waste problem, but could become a valuable local resource to reduce poverty and support sustainable development. Clean, low-cost heat and power, based on such biomass, could increase living standards, promote industry and create jobs here and in rural areas throughout developing countries – while cutting dangerous indoor air pollution from traditional cooking stoves and combating global warming.

Expanding operations

Biomass has already successfully been turned into gas in Jilin and other Chinese provinces to provide a clean cooking fuel for rural villages, but these projects have not been economically attractive because they generally only operate for about six hours every day, which is not sufficient to recover the capital cost. The Hechengli project will expand the plant incrementally to meet the village's needs for electricity and heat – in an area where annual temperatures average just 2.5°C – and sell surplus power to the national grid. The added revenues from the expanded

China is adhering to a sustainable energy development strategy in the new millennium, minimizing energy consumption's impact on the environment

□ Promoting the clean use of coal and cutting emissions of various pollutants. China will make efforts to promote and commercialize clean coal power generation technologies like coal washing, coal selection and coal concentration. Research will be carried out on carbon collection and the use of hydrogen.

□ Sticking to its effective energy-saving policy, which has achieved obvious results over many years. In the new millennium, China will increase people's awareness of energy saving, and implement effective measures more widely. Energy saving is regarded as a fundamental approach for China's sustainable development.

□ Coordinating energy development and environmental protection as the common aspiration of human beings: this requires joint efforts by the governments and people of the whole world. The Chinese Government will actively promote energy cooperation with the international community. We hope we can carry out exchange and cooperation, learn advanced technology and share experience from other countries. We are ready to establish an active dialogue with other nations and international energy organizations on such issues as energy safety and supplying energy to poverty-stricken people. As a member of the 'global village', China will work together with all the world's countries for a more civilized, more affluent and cleaner future ■

Ma Kai is Minister in Charge of the State Development and Reform Commission, China.

Pat DeLaquil

Pat DeLaquil

People are optimistic about being at the cutting edge of energy technology, expanding industry and eco-tourism, and reducing pollution

operation of the plant will make it economically attractive.

Furthermore, the people of the village believe it will also help them expand their industry by providing process heat for factories in summer and by heating greenhouses for growing vegetables in winter. Use of the gas instead of traditional cooking fuels (wood and coal) will greatly reduce the high levels of indoor air pollution that cause acute respiratory infections, chronic obstructive pulmonary disease, lung cancer, tuberculosis, asthma and blindness across the developing world.

Environmentally sensitive

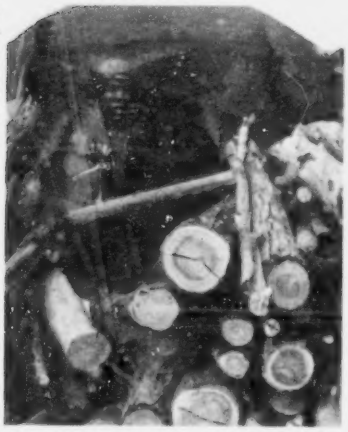
Jilin Province is an ideal place for the project because it has not just abundant biomass and a need for rural development, but an emerging industrial base and a government with the commitment needed to ensure the sustained growth of such a new industry. Hechengli, as an Ecological Village, already has an environmentally sensitive development plan, and is well placed to use extra energy to promote non-polluting industry and expand the greenhouse production which already provides income for over half its households.

The village has a dynamic, entrepreneurial and community-minded leadership and the people are optimistic about being at the cutting edge of energy technology, expecting more energy for less labour, expanding industry and eco-tourism, and reducing pollution.

Cornerstone of progress

There is a vast potential market for the modern biomass technology. The province generates some 40 million tonnes of agricultural residues a year. If just half of this were to be converted to clean gas and electricity in this way it could meet the needs of more than 1.7 million households – half Jilin's population – while adding 1,400 megawatts of new generating capacity to the grid, an increase of nearly 30 per cent. And the example could be replicated around the world, making sustainable development through modern biomass technology a cornerstone of rural progress ■

Liu Shuying is the Vice Chairperson of Jilin Provincial People's Congress and National Project Director for Modernized Biomass Energy, China.

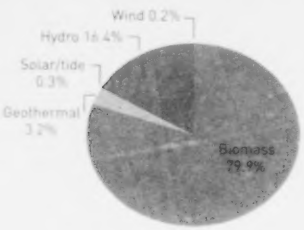


At a glance: Energy

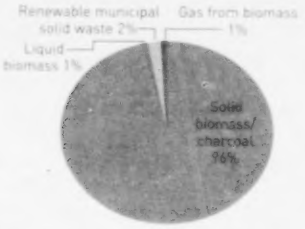
Every year millions of people – many of them children under five – die because they cannot use modern sources of energy. Two in every five of the people on the planet have to burn wood, charcoal, dung and other forms of 'traditional biomass', usually on open stoves and fires. The smoke contains a cocktail of poisonous chemicals, which swirls around their homes, causing acute respiratory infections, asthma, cancer and other diseases. It is one of the world's greatest, and least publicized, environmental crises, and it is getting worse as the spread of commercial energy fails to keep up with population growth and more and more people are forced to resort to traditional fuels.

Meanwhile, the energy use of the rich is mainly to blame for another escalating emergency – global warming. Carbon dioxide (CO_2) emissions from the burning of fossil fuels have more than doubled since 1965: global temperatures and atmospheric concentrations of the

Renewable energy, by type, 2001



Biomass energy, by type, 2001

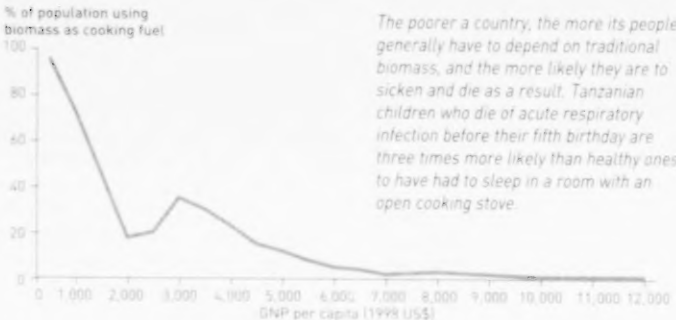


Share of biomass in national energy consumption, 2001

Some two and a half billion people have no access to any form of modern energy and have to burn 'traditional biomass' – such as wood, charcoal and dung – for heating and cooking. In some countries it provides over 90 per cent of national energy supplies. It dominates the global use of renewable energies – but in many ways this is a misnomer, for cutting trees and removing wastes from the land faster than they are replaced reduces its fertility and leads to soil erosion.

Trends in use of biomass as cooking fuel relative to GNP per capita

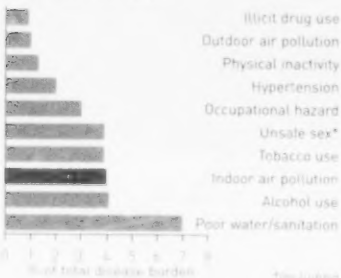
(end of 20th century)



The poorer a country, the more its people generally have to depend on traditional biomass, and the more likely they are to sicken and die as a result. Tanzanian children who die of acute respiratory infection before their fifth birthday are three times more likely than healthy ones to have had to sleep in a room with an open cooking stove.

Global burden of disease, selected major risk factors

(end of 20th century)



*Including unwanted pregnancy

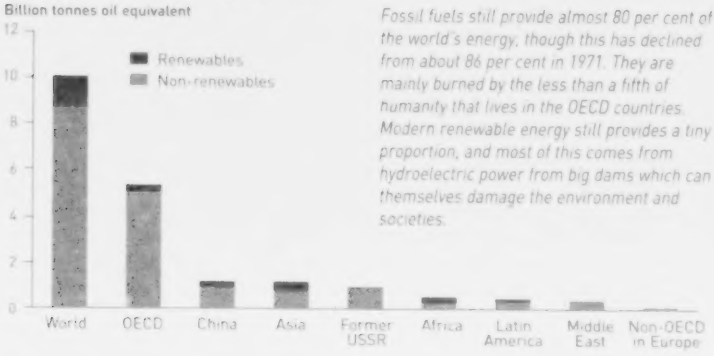
greenhouse gas have duly risen too. Signs of climate change are already appearing: retreating glaciers, thinning sea ice, rising sea levels, and more frequent, more intense storms and droughts. Disaster threatens unless the rate of change is brought under control.

Developed countries emit most of the CO_2. Per capita emissions are ten times higher in North America than in developing nations as a whole. Rich countries urgently need to reduce their energy consumption, through conservation – many experts call for a fourfold increase in efficiency by 2012 – just as poor ones need to increase their own energy consumption efficiently in order to develop.

Modern renewable sources of energy – using the sun, the wind and small-scale hydroelectric power, for example – can help tackle both crises. Distributed free by nature, they can bring clean energy and electricity to the scattered villages where about half the world's people live. And their vast potential could allow developed countries to move onto sustainable energy paths that combat global warming and other pollution. But they have received far too little attention: solar and wind power, though growing fast, still provide only about 0.02 per cent apiece of the world's energy supplies. A new energy revolution is long overdue.

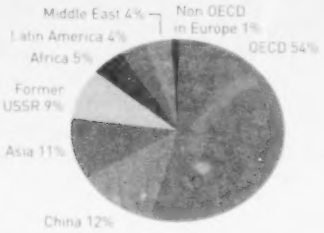
Geoffrey Lean

World primary energy supply, 2001

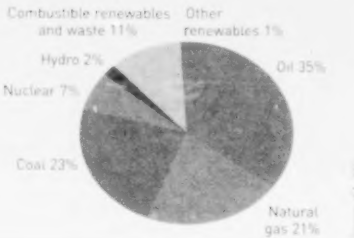


Fossil fuels still provide almost 80 per cent of the world's energy, though this has declined from about 86 per cent in 1971. They are mainly burned by the less than a fifth of humanity that lives in the OECD countries. Modern renewable energy still provides a tiny proportion, and most of this comes from hydroelectric power from big dams which can themselves damage the environment and societies.

Regional share of total primary energy supply, 2001

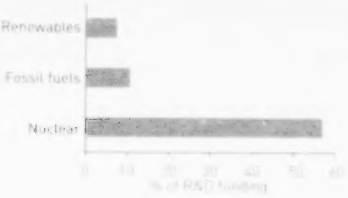


Fuel share in total primary energy supply, 2001



Priorities for energy R&D in major industrialized countries

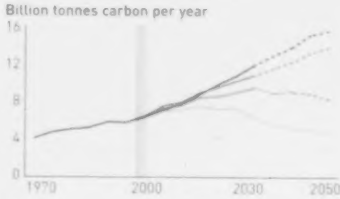
(end of 20th century)



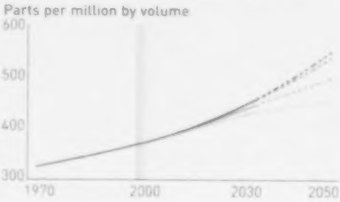
Nuclear power has dominated research funding in developed countries for decades, but has failed to meet its promise. The building of new reactors declined sharply from the mid-1970s to mid-1980s, and few have been started over the last 15 years. Much more research is needed on renewables if they are to meet their potential and help both developed and developing countries towards sustainable development.

Scenarios

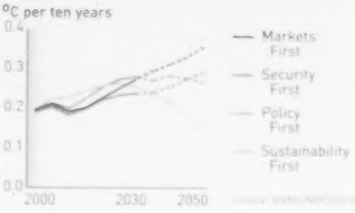
CO_2 emissions, all sources



Atmospheric CO_2 concentrations



Rate of global temperature change



Global temperatures – and CO_2 concentrations – will continue to rise, but the rate of increase can be cut. In four UNEP scenarios – Markets First, Policy First, Security First and Sustainability First – only the last puts concentrations on a trajectory to stabilize by mid-century and reduces the rate of temperature increase over 50 years. But even this ends up with an increase of well over 0.1°C a decade, the level above which damage to ecosystems is likely to occur.

STAR PROFILE

SUSTAINABLE DREAMS

CHIN-CHIN GUTIERREZ

Louis-Paul Brassoff

Toni Kalevi

Onscreen, Chin-Chin Gutierrez, one of the Philippines' most celebrated film stars, has recently played a sophisticated villain in a popular national soap opera. In real life, she spends a third of her time campaigning for sustainable development – from warning against climate change to digging holes and composting rubbish – and has been hailed by *TIME* magazine as a hero for it.

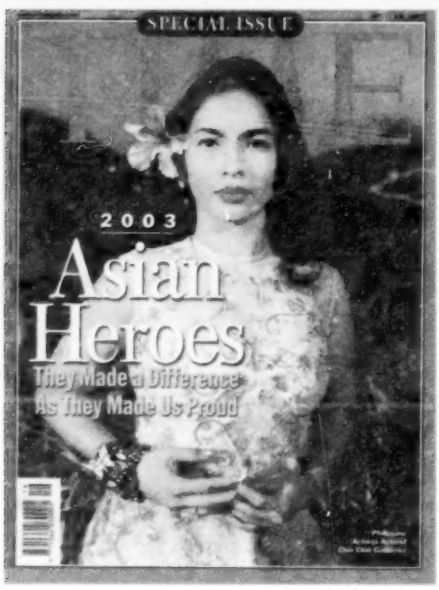
The winner of both 'best actress' and 'best supporting actress' in the Asian Television awards, among other prizes – and with an extraordinary versatility of roles, including heroines and dramatic leads – she doubles as a leading activist of the Mother Earth Foundation, a Filipino non-governmental organization which has successfully campaigned for a national Clean Air Act and waste legislation. Earlier this year she appeared on the cover of the international news magazine as a 'hero of Asia', for 'using her fame to spread a message often ignored … that there are natural resources aside from beauty and talent'.

'I am an actress and I traffic in dreams,' says the 29-year-old Gutierrez, who broke new ground by playing her first anti-hero in the soap, *Habang Kapiling Ka*. 'A dream can be a vision of tomorrow's reality. I think it is the duty of every citizen of the Earth to dream of a sustainable future for their country.'

She was, in a sense, born into environmental concern. Her father was a botanist. Her paternal grandfather, a pharmacologist, used to walk in the fields in his bare feet, so as not to disturb wildlife. And one of the first modern environmental books – *Our Plundered Planet* by Fairfield Osborn, published in 1948 – was dedicated by the author to her maternal grandfather, Solomon Arnaldo, an early director of UNESCO's office in New York.

But it was a typhoon that first sparked her activism. Six years ago she went to a sacred mountain, Mount Banahaw, south of Manila, to research a role before playing the head of a religious sect that lived there. The typhoon delayed the arrival of the television crew and the week she spent there changed her life.

She returned to the mountain again and again – eventually spending every weekend there – to work with the local people, planting trees and cleaning up the rubbish left by tourists, 'reminding people of the sacredness of the mountain by protecting and restoring its ecological balance'. It became a focus for the Mother Earth Foundation, where she serves as chairperson for projects.



Oliver Lauk

Earlier this year she took part in a UNEP workshop on sustainable development in Bangkok. 'It really helped me a lot,' she says. 'It clarified and strengthened my ideas and beliefs on sustainable development.' And she draws extensively on UNEP's GEO3 report for educational work, visiting local communities to explain the concept of ecological footprints.

Global warming

For example she uses facts on the shrinking of the world's glaciers to introduce climate change. 'The indicators of climate change tell us that we human beings have no choice but to grow up. The Earth can live another one and a half billion years, but maybe the human species will not survive global warming. We have enough information, but do we have enough will to do what is needed?

'I dream of the curse of poverty being lifted from the majority of Filipinos. Poverty is the biggest obstacle to sustainable development. The tragedy of environmental deterioration in the Philippines is compounded by the realization that it is the majority of the population that lives below the poverty line that depends on biodiversity for food and shelter. Thus – to adapt a thought by Paul Hawken, one of the writers who has most influenced me – the environmental movement in the Philippines must transform itself from a struggle to save the Earth to a struggle to defend human rights: the right to food, the right to livelihood, the rights to culture, community and self-sufficiency' ■ *GL*

Brightening the future

LEONARD GOOD describes increasingly successful worldwide efforts to promote clean energy and power sustainable development

Energy is the lifeblood of the global economy, and an essential prerequisite for development. In the industrialized world, high levels of its use have become synonymous with consumerism and modernity, while in developing nations, greater use is associated with meeting basic human needs. By providing sufficient light to extend the day, by supplying energy for cooking, and by powering a pump to eliminate lengthy, exhausting walks to fetch water, a small amount of commercial energy is the key to liberating millions from the burden of poverty. The gross disparity in per capita energy use is a sad reminder of the magnitude of inequities in access to basic services; in the least developed countries, electricity use per capita is only 1 per cent of what it is in the industrialized nations.

Access and impact

The challenge of energy for development is largely defined by two distinct but related issues: access and environmental impact. Expanding its supply to those who currently lack access to modern energy sources is critical. Some 2 billion people do not have access to electricity and can tap only limited sources of kerosene, charcoal or other low-quality fuels. Developing countries must generate more energy to reduce poverty and meet growing demand.

But increased use of commercial energy has significant environmental implications. Local air pollution causes perhaps 4 million premature deaths per year, mostly of young children exposed to dirty cooking fuels. The economic costs of air pollution amount to over $350 billion per year, or 6 per cent of the gross national product of developing countries. There is also the added global risk from climate change associated with the build-up of greenhouse gases from the combustion of coal, oil and natural gas. Despite their relatively low per capita consumption, developing countries have the fastest economic and population growth: within a few decades, their contributions to greenhouse gas emissions are likely to exceed those of industrialized nations. The Global Environment Facility (GEF) believes that accelerating the transition to efficient and renewable energy will bring enormous economic, social and environmental benefits. As the chief funder of renewable energy in developing countries, it is playing a leading role – in partnership with UNEP, the United Nations Development Programme and the World Bank – in expanding the introduction of clean energy technologies. In 12 years, its clean energy portfolio has grown to more than $1.6 billion in grants for projects with a total value of more than $10.6 billion.

Expanding renewable energy

Renewable energy is taking India, for example, by storm. The Government's favourable investment tax policies, commercial financing and supportive regulations have all contributed to this. By 2000, almost 1,200 megawatts of wind capacity had been installed in the country, virtually all by the private sector. Dozens of domestic manufacturers have emerged and are already exporting high-tech turbines with variable speed operation. The GEF has helped finance 41 megawatts of wind turbine installations and 45 megawatts of mini-hydro capacity in the country through the Renewable Energy Development project, while the India Renewable Development Agency, strengthened through project assistance, has financed another 360 megawatts of wind farms and 130 megawatts of mini-hydro stations.

Similarly, the GEF has had a significant impact in expanding solar energy for electricity and hot water in countries as distinct as China, Peru and Ghana. Sri Lanka's Energy Services Delivery Project is one of the world's ▸

Hu Qiang, Host I NEP System

most successful solar undertakings: our contribution helped provide electricity for villages not served by the grid. By the end of 2002, almost 20,000 Sri Lankan homes had solar electricity through an innovative micro-financing approach that made it easier for rural people to obtain bank loans for the purchase of solar home systems. Meanwhile, a GEF project in Morocco is successfully expanding the use of solar hot water heaters that cost less than conventional water heating, and save energy. Government agencies and private firms were trained to promote, evaluate and install solar hot water systems in homes and businesses: so far 80,000 square metres of solar hot water collectors have been installed.

Transforming markets

Forward-looking energy companies seeking investment opportunities in developing countries are increasingly focusing on ensuring economic and environmental benefits. GEF is working on three continents to partner with them and share the risks of expanding markets for renewable energy and energy-efficient products, accelerating a worldwide transition to clean energy. One new project, to transform the market for energy-efficient refrigerators in China, is already altering the fundamental structure of the marketplace through new refrigerator standards. Another project, in Poland, has had a significant impact on the market for compact fluorescent lamps. Lower prices – through a manufacturer subsidy – combined with a mass media campaign, resulted in sales of over 1.2 million of the lamps in three years, and increased the proportion of Polish households using them from one in ten to one in three. The project clearly demonstrated the financial and commercial benefits of energy-efficient lighting, saved large amounts of power, and reduced emissions from coal-fired generating plants.

Bright future

Worldwide efforts are using energy-efficient lights, solar, wind, geothermal, biomass and small hydropower technologies for electricity generation, heating, cooling, lighting and other productive activities. With some 15 per cent of the world's energy consumption already coming from renewables, the future looks really bright. More than 1 million homes in the developing world are now powered by solar energy, while wind capacity has increased from zero to over 1,700 megawatts – enough to power more than 5 million typical homes. India alone now has 40,000 solar streetlights. India and China are poised to add more than 10 million solar systems in coming years, while some 60,000 systems are anticipated in Argentina and 300,000 more in the Republic of South Africa.

The Global Environment Facility unites 175 member governments – in partnership with the private sector, non-governmental organizations and international institutions – to address complex global environmental issues while supporting national sustainable development initiatives. It has allocated $4.5 billion in grants and leveraged $14.5 billion in additional financing for more than 1,200 projects in over 140 developing countries. In August 2002, donor nations pledged an additional $3 billion, the largest replenishment ever, to expand and accelerate its work.

Some 15 per cent of the world's energy consumption already comes from renewables

GEF strategies to promote clean energy increasingly emphasize the need for sustainable business models, country partnerships and financial leverage. The renewable energy industry is now worth over $10 billion per year and growing in double digits. Thirty major firms, including BP and Shell International, have announced plans to invest from $10 to $15 billion in renewable energy worldwide in the next five years. Development agencies have expanded their efforts to foster market growth by working to remove market barriers. And some markets for renewable energy in developing countries, such as in Kenya, have emerged without any explicit development assistance, primarily through private sector initiative. We will continue to stimulate such innovative investments and to play a leading role in promoting clean energy ■

Leonard Good is CEO and Chairman of the Global Environment Facility.

Greening oil

PHILIP WATTS describes what his company is doing to reduce its impact on the environment and develop cleaner energy

'We now understand that both business and society stand to benefit from working together,' said Kofi Annan, the United Nations Secretary-General, at the 2002 World Summit in Johannesburg. 'And more and more we are realizing that it is only by mobilizing the corporate sector that we can make significant progress.' It was a most welcome recognition of the role business can play in meeting the challenges of sustainable development.

Shell is playing its part both individually and as part of the World Business Council for Sustainable Development, which I have had the privilege of chairing over the past two years. This is part of a clear commitment to contribute to sustainable development, which is at the heart of the way we operate. That means we take account of environmental and social considerations as well as economic ones in making our business decisions.

We know that oil and gas exploration and production can have an impact on the environment and are determined to minimize it and ensure the long-term legacy of these operations is a good one.

Protecting the world's biodiversity is a particularly important aspect of our work, and we are working in partnership with a number of conservation organizations. These include a project with the Smithsonian Institution in Gabon that is researching and cataloguing the immensely rich natural environment around the oilfields in the Gamba complex. It is extremely encouraging that the research so far has suggested that, despite almost 40 years of oil operations, the environment in the area is as rich as ever.

Integrating biodiversity

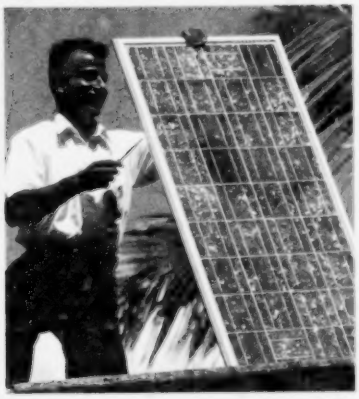
We have been working with other companies and conservation organizations in the Energy Biodiversity Initiative in recognition of the particular responsibilities of energy companies in this area. As part of this, the Shell Group has developed tools and guidelines on best practice in integrating biodiversity into oil and gas development. We hope these will form the basis for a common approach by the industry.

This builds on the approach we have taken to integrate biodiversity into our project planning and operations. The environmental impact of any project is assessed right from the start and safeguards are put in place to mitigate any negative effects. There is an early dialogue with stakeholders to ensure that their concerns are addressed. Biodiversity is important wherever we work and we try to ensure that all our operations take place in a responsible way which respects the local environment.

World Heritage

We also recognize that there are some areas of the world which are too sensitive for any oil and gas operations to take place. Earlier this year, I announced that Shell would not explore for oil and gas in any Natural World Heritage sites. This is a very significant step and represented a real commitment to place respect for the environment at the heart of the way we do business. But protecting biodiversity is just one part of the work across the Shell Group to minimize the environmental effect of our operations.

Every year we report publicly in the *Shell Report* on our performance on a range of environmental and social indicators including emissions, spills and energy efficiency. The data are independently verified where possible, and we work hard to ensure that the report is an open and honest account of our record and can form the basis of an ongoing dialogue with our stakeholders. Publishing these data provides a powerful incentive ▸



to improve our performance. The latest report shows we have made progress on a number of indicators, although we have more to do to ensure consistency across the whole Shell Group.

Our performance against our target for greenhouse gas emissions is one of the key measurements set out in the report. Shell shares widespread concern that the emission of these gases from human activities is leading to changes in the global climate. We believe action is required now to lay the foundation for eventually stabilizing their concentrations.

We set a target of reducing greenhouse gas emissions from our own operations by 10 per cent from 1990 levels by 2002. Had we taken no action, the development of our business over that period would have resulted in an increase of more than 20 per cent. We met that target last year and have now renewed our commitment with a new one – to ensure that, in 2010, emissions are still at least 5 per cent below the 1990 level.

Responding to the energy challenge will require both more efficient use of existing hydrocarbon resources and work to develop the potential of alternatives

Sound business

Shell is also working to help our customers reduce their emissions from energy use. This raises one of the greatest challenges facing us all: how to meet growing global demand for energy in a way which does not harm the environment. Successfully meeting this challenge will require both more efficient use of existing hydrocarbon resources and work to develop the potential of alternatives such as renewable energy and hydrogen.

Natural gas in particular can offer a bridge to increased use of renewable fuels in the longer term. Gas produces significantly lower carbon emissions than oil or coal and Shell is developing new gas projects around the world and seeking new markets for that gas. At the same time Shell is building a renewables business and supporting research and development of hydrogen. While it is clear that renewables cannot be a quick fix, Shell is helping them to increase their role in the energy mix and is becoming a leading player in the provision of wind and solar energy in a number of projects around the world.

Shell takes its responsibilities to the environment very seriously. There are sound business reasons why we need to do so. Our customers, those who work with us and the communities in which we operate expect us to meet the highest standards. By meeting those expectations and respecting the communities and environments in which we work we can develop our business and ensure its continued success ■

Sir Philip Watts is Chairman of the Committee of Managing Directors of the Royal Dutch/Shell Group of Companies.

Blue-sky thinking

TAKEO FUKUI describes how his company seeks its customers' respect though an aggressive programme of developing green technology

Global environmental problems – such as the greenhouse effect, the depletion of natural resources and the accumulation of wastes – have been recognized as common international issues affecting humanity since the 1990s. Sustainable development on a global scale is now sought, for instance, with the establishment of the targets for greenhouse gas reduction in the 1997 Kyoto Protocol, and with the adoption of the Declaration on Sustainable Development at the 2002 Johannesburg Summit.

Honda launched the slogan 'Blue Sky for Children' in the 1960s when environmental pollution became a highly visible issue. During that decade we started an aggressive approach aimed at substantial environmental improvement, and unveiled the Compound Vortex Controlled Combustion (CVCC) engine – which used unique low-emission technology – in the United States and Japan. Since then, we have developed the Variable Valve Timing and Lift Electric Control System (VTEC) and the i-VTEC series with innovative engine technology, permitting global production of vehicles that combine high performance with state-of-the-art low-emission technologies. And we continued to work to preserve the global environment by releasing a hybrid vehicle, the Insight, which achieved the most efficient fuel consumption in the world at the time of its introduction in 1998.

Sharing advances

This kind of effort is not limited to our cars. We have expanded it to all our products. We have converted two-stroke engines to four-strokes in motorcycle production for mass sale, and applied fuel injection systems to small motorcycles. We have, moreover, continuously adopted four-stroke engines in multipurpose engine products throughout our product line substantially ahead of the schedule required by the US Environmental Protection Agency's exhaust emission regulations. These proactive initiatives have resulted in Honda sharing the technological advances of its motorcycles, vehicles and multipurpose engine products with over 15 million people all over the world.

Achieving energy savings

We have aggressively implemented our corporate approach by developing and adopting environmental management systems. Among these is a unique Life Cycle Assessment system, which we have developed as a tool for conducting a qualitative assessment of environmental loads in all active areas, allowing the introduction of effective countermeasures to reduce them. This system enabled us, for example, to achieve energy savings and cost reductions by identifying high energy consumption, and taking appropriate action at an early stage in product development. We are utilizing a similarly proactive approach in all corporate activities, including purchasing, logistics and sales.

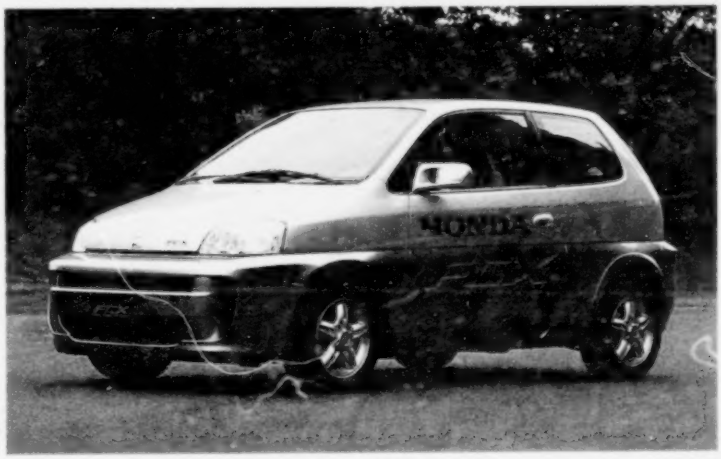
Environmental enterprise

Honda is fully committed to being a company that our customers from all over the world can look up to as we approach the year 2010. To this end, we have enhanced our environmental conservation activities, working to become a leading environmental enterprise. This has resulted in the significant achievement of obtaining the first US Government certification for a fuel cell car, the 'FCX', enabling us to deliver a certified FCX to both the Los Angeles City Government and the Japanese Government in 2002 for commercial use. More recently, the City of San Francisco and a Japanese hydrogen production company have joined our customer base.

In conclusion, we would like to further our commitment to the environment throughout our corporate activities and continue to provide our customers with product satisfaction ■

Takeo Fukui is President and CEO of the Honda Motor Co. Ltd.

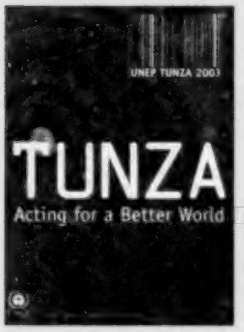
Honda has obtained the first US Government certification for a fuel cell car, the 'FCX'



Honda

BOOKS & PRODUCTS

TUNZA **Acting for a Better World** *is a richly illustrated guide to sustainable development issues for young people, by young people. Boldly designed, and dedicated to the youth of the world, the kit was launched at the inaugural* ***Tunza International Youth Conference*** *in Russia in August 2003. The book is intended to increase awareness on environmental issues and to provide young people with access to credible and relevant information that they can adapt to address problems and influence their communities. It is also hoped that TUNZA will contribute to the development of good environmental ethics among youth and enable them to cope with current environmental challenges and those of the future. The book is available from www.earthprint.com, $20 plus postage and packing* ■



Facts about the world water crisis and examples of positive community action are given in ***Troubled Waters: a Profile for Community Action*** produced by the **Harmony Foundation of Canada**. It is the latest in a series of profiles, which also cover biodiversity and climate change, as companion to the *Community Action Workshop Manual* which provides a process for planning community projects and education programmes ■

Harmony

US environmentalists and safety experts have come up with a new way of tackling the increasing love affair with the sports utility vehicle (SUV) – designing a better one. **The Union of Concerned Scientists** and the **Center for Auto Safety** have launched the Guardian, which has the same power and performance as current models, but is much safer and uses much less fuel. Each SUV contributes 40 per cent more to global warming than an average car, and the vehicles are responsible for most of last year's increase in road traffic deaths in the United States: they have lower safety and fuel standards to meet than cars. The new design includes many more safety features and boosts fuel performance by up to 71 per cent. The designers say that, if applied to the whole US fleet over the next five years, it would save oil equivalent to half the country's imports from Saudi Arabia each year ■

Union of Concerned Scientists

Climate Affairs, *by Professor Michael Glantz, the senior scientist at the* ***National Centre for Atmospheric Research*** *(published by Island Press) is a concise presentation of the many dimensions of the world's increasing vulnerability to climate change. Dr R.K. Pauchari, the Chairman of the Intergovernmental Panel on Climate Change, calls it: 'an extremely perceptive and persuasive analysis'* ■

Regional Transportation Center

It looks like a conventional petrol station, but it sells the widest range of alternative fuels in any one location in California, which is leading the world in the drive for non-polluting ways to power cars. The station in the City Heights district of San Diego sells compressed natural gas, liquefied propane gas, ultra-low sulphur diesel and biodiesel made from recycled oil used for making French fries. The brainchild of **Steve Bimson**, a former marketing director at a local Ford dealership, it also charges up battery-powered cars. California's official goal is for 10 per cent of its new car sales to be of zero- or low-emission vehicles by 2005 ■

ITDG/Dr Nigel Bruce

New smoke hoods to combat deadly indoor pollution from cooking stoves and fires are being installed in homes of Maasai people in the Kajaido area of Kenya. The smoke hoods have been designed by the **Intermediate Technology Development Group** in close cooperation with the communities. Made out of local materials, the hoods draw smoke and fumes up and away from the hearth and out through a simple chimney, which cuts indoor pollution by up to 70 per cent ■

New energy *to assault poverty*

YOUBA SOKONA outlines strategies for widening modern energy services to poor nations and people in Africa

Energy can play a pivotal role in significantly reducing poverty and building sustainable development – the major challenges of the third millennium. It is an elemental aspect of the natural, physical world and of the economic and social systems of humankind. There is no physical science that is not at the same time an attempt to describe the manifestation of energy, as there is no history of society that is not also a history of harnessing and using it.

Essential yardstick

Energy, therefore, is one of the critical areas where technology, economics and politics intersect. Its centrality to social and environmental issues is beyond question, as is its key role in any system of planning or developing society. As the resource from which other resources follow, it is fundamental to any attempt to combat poverty, and an essential yardstick for economic and social development.

Africa's current energy poverty and inefficiency are dismal. The lack of access to energy services for the vast majority of Africans constitutes a major obstacle to the continent's sustainable development. Improving access for poorer and marginalized communities would make a significant difference in the fight against poverty.

Access to affordable and appropriate energy services must and should grow significantly to improve the standard of living of the continent's growing population. Modern forms of energy would transform living conditions and boost industrial, agricultural, urban and rural development. Unreliable and costly supplies of electricity and modern fuel impede production, growth and development in many commercial enterprises. Increasingly high oil import bills – and financial losses at parastatal energy utilities – handicap national economies.

The principal energy sector initiative of the 1990s – privatizing and reforming energy supply utilities – is helping to improve their solvency, reduce debt burdens, and guarantee a reliable provision of energy services to those able to pay. But much more needs to be done, on many fronts. Policy reform, social development and institutional development are crucially needed to unleash the great potential of the region's energy and other natural resources.

Modern forms of energy would transform living conditions and boost development

New thinking

It will be essential to develop models, new types of institutional arrangements, policies and approaches that really work under the conditions currently prevailing in Africa. The uncritical transfer of ideas from other continents has not worked. New thinking is particularly needed to achieve regulatory reforms that address the poverty reduction agenda, and to develop new forms of restructuring that are appropriate to small systems located within a macroeconomic context which is often unattractive to foreign capital, and suffers from a lack of trained people.

Besides this new thinking, critical actions need to be taken to meet Africa's need for more sustainable energy systems that will serve human needs and aspirations. Many of the elements of such actions are already well known:

- The supply and use of biomass fuels, the dominant energy source of Africa, have to be made more sustainable and less costly in human terms – reducing drudgery and improving health for children, women and men.
- Affordable access to modern energy services (notably through electrification and distribution of liquid and gaseous fuels) must be extended to all who lack it.
- The efficiency of energy production, distribution and use must be improved to enhance economic productivity and reduce environmental hazards. In some cases, cleaner fuels and energy processes are also required to meet environmental goals. ▶

Indigenous energy resources must be expanded to promote self-reliance and reduce net import costs. These include the large potential for renewable energy, which should be vigorously promoted wherever it brings real economic benefits and reduces local and global environmental impacts.

Bringing change

Many technical and policy measures are available to bring such changes about: lower-cost energy technologies attuned to the region's diverse settings; local research, development, demonstration and testing capabilities; effective technical support services; good access to credit to lower often prohibitive investment barriers; and a variety of policy and institutional measures designed to put these changes in place and promote their self-sustaining 'take-off'. All these should be developed.

Realizing significant poverty reduction and sustainable development in Africa in the near future remains a big challenge. The following could help in mapping the road ahead:

Policy focus: African energy policies have been shaped by donor-funded projects, which have undoubtedly played a valuable role. But sound policy decisions are more meaningful, and have greater impact, than a series of projects. Similar effort spent on policies and institutional reforms would yield tangible results and encourage local initiatives to take root and progress within a more sustainable framework.

New government roles: The reform process undermines traditional public sector energy planning and development. Governments need to adopt new roles, including promoting energy research, development and demonstration, subsidies and regulation. Defining and adjusting to these new roles will be a major challenge.

Capacity building and development building: In many African countries emerging changes, such as the move to market-based energy development, have been severely constrained by weak capacities and infrastructure. These must be strengthened. Difficult questions remain about how these new structures are to be built and/or transformed to replace current government-centred planning. How should these tasks be divided between a number of pertinent government agencies – for example, government-private sector partnerships, or commercial businesses? And how quickly can effective systems be put in place?

Good credit financing and technical support: Easy access to credit, spare parts and good after-sale services are among the key driving forces of consumer-led technical development in industrialized countries. One cannot overestimate the importance of providing the same benefits – appropriately adapted to local circumstances – to the market for sustainable energy products in Africa.

Regional cooperation: Africa has much in terms of rich but localized

New energy *entrepreneurs*

FRANCIS YAMBA describes a programme which brings sustainable development by supporting businesses pioneering energy solutions in developing countries

Living in Lusaka, Fredrick Musonda noticed two things. Increasing demand for the most common fuel, charcoal, was supplied by native trees 'carbonized' in simple, but inefficient, earth kilns. And the local sawmill, using logs from eucalyptus plantations, simply burned the waste from its operations. So he started a company to manufacture charcoal from sawmill waste in more efficient kilns.

This was an important step in a country where demand for charcoal, already 900,000 tonnes a year, is rising by 4 per cent annually. This growth, together with inefficient production methods, increases deforestation – and the associated soil erosion, water pollution and biodiversity loss – leading Zambians to an unsustainable energy future.

The new company, called KBPS, successfully serviced an initial market. Mr Musonda wanted to expand but was stopped because, as is often the case in developing countries, conventional forms of finance were not available. Then he heard about an innovative UNEP programme – the African Rural Energy Enterprise Development (AREED) initiative, supported by the United Nations Foundation and E+Co, a United States-based, non-profit investor. AREED works with local partners to combine business training with small amounts of start-up capital for entrepreneurs who want to deliver better, profitable energy services to rural people in Ghana, Mali, Senegal, Tanzania and Zambia.

Mr Musonda sought AREED's help both in planning his business expansion and in providing the seed capital to fund it. AREED was interested because his enterprise could help to solve an energy problem and an environmental problem at the same time by producing charcoal from the waste product of a renewable forestry practice. KBPS could demonstrate how charcoal can be made without causing or exacerbating deforestation – offering great potential for replication elsewhere.

Moreover, charcoal production is employment intensive, and the more efficient kilns can reduce environmental damage, for example by cutting carbon dioxide emissions by almost 33,000 tonnes a year in this project alone.

Efficient production

Mr Musonda worked with the local AREED project officer from the Centre for Energy, Environment and Engineering in Zambia and an E+Co investment officer to structure a commercially viable and profitable venture with minimum risk. They determined that KBPS should construct 15 additional brick kilns specially designed to be more efficient than traditional earth ones. These would enable the company to produce about 2,000 tonnes of charcoal in the first year of operation – or about 1 per cent of total demand in the targeted area – rising to almost 3,000 tonnes of charcoal in the subsequent four years.

energy resources and potential. But these are typically limited by small local or national demand. Cross-border energy trading (not only electricity) and other forms of regional cooperation offer large potential benefits.

□ *Energy and environment nexus:* Global environmental issues such as climate change present both constraints and opportunities for African countries. The current debates could result in new forms of North-South cooperation and strategic vision over the short, medium and long term. Mitigating and adapting to climate change can offer the opportunity to revisit development strategies – and, particularly, sustainable energy options – from a new perspective with renewed urgency, to better understand the connections to other environmental problems, improve integration of environment and development issues and address such other issues as income distribution. The challenge is to ensure that the resulting action contributes to local and regional development, rather than obstructs it, and does not divert attention and resources away from the primary aim of reducing poverty.

□ *Gender and energy nexus:* Energy policies cannot continue to be gender-blind. Women's energy needs are often different from those of men and their benefits should be commensurate with their efforts. Making energy services accessible to rural and urban women will contribute immensely to their socio-economic development and afford a better quality of life. Ensuring that energy services meet their socio-economic aspirations is essential if poverty alleviation is to attain its true meaning. Reducing gender inequalities, moving towards greater equity, and building a viable sustainable development path in which women could reclaim an active and participatory role, are all challenges that must be met ■

Youba Sokona is Head of Energy Program, ENDA-TM, Senegal.

The team then completed a comprehensive business plan to guide KBPS's expansion and AREED lent it approximately $75,000 for five years at 12 per cent interest. By the time it received the final loan instalment in February 2003, KBPS had constructed ten new kilns and others were being built. Charcoal production had increased to approximately 960 tonnes a year.

Continued support

The company, however, faced several new challenges that required a change in strategy from the original business plan. AREED was there to help with post-investment services – crucial elements in the design of programmes that combine business dimensions with sustainable development. It will continue to support KBPS in implementing the venture.

This is just one of 15 enterprises which AREED has provided with development services and nearly $1 million in start-up capital. They offer energy services ranging from industrial energy efficiency to solar-powered electricity and the supply of liquid petroleum gas.

Following its success, a similar programme, B-REED (www.b-reed.org) is operating in Brazil and has already invested in companies supplying solar-powered irrigation pumps and creating wood fuel from plantations for brick manufacture. Another, CREED, has just started in China's remote and biologically diverse Yunnan Province in partnership with The Nature Conservancy.

Together, they are demonstrating that an enterprise-led programme, supported by business development services and small amounts of start-up capital delivered through local and international partners, can be the missing link to sustainable development ■

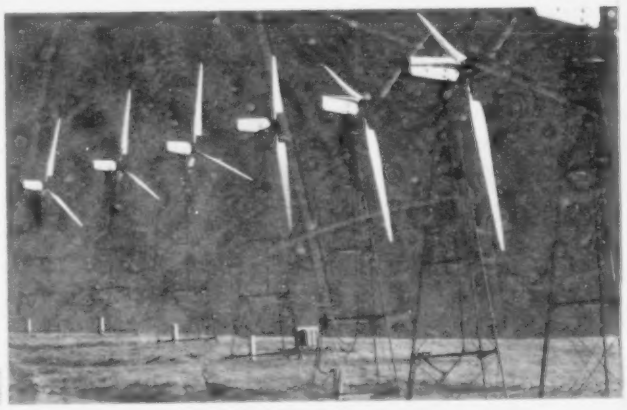
Francis Yamba is Director of the Centre for Energy, Environment and Engineering in Zambia.

Additional resources: *Open for Business: Entrepreneurs, Clean Energy and Sustainable Development*, a 32-page UNEP publication describing the REED programmes (www.uneptie.org/energy/publ/openforbusiness.htm); *The REED Report*, September 2003, a four-page summary of the latest REED news (www.uneptie.org/energy/).

An enterprise-led programme can be the missing link to sustainable development

Time to get SERIOUS

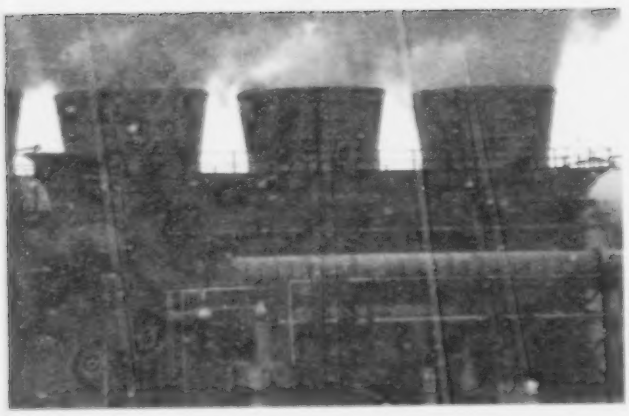
EILEEN CLAUSSEN calls for immediate steps to create a strategy for a climate-friendly energy future



Energy use and climate change are inextricably linked. Choices made today in energy policy debates around the world will directly impact global greenhouse gas emissions far into the future. Often, the objectives of energy and climate policy are thought of as competing goals. In reality, there can be a substantial convergence between them. Many feasible and beneficial policies from supply and security perspectives can also reduce future greenhouse gas emissions. Yet the task at hand is not easy: we must significantly reduce our emissions from the use of fossil fuel, and begin in earnest to develop the technologies and alternative energy sources that will help achieve real and steady reductions in worldwide emissions of greenhouse gases.

We have a problem. The Earth's climate is undergoing important and potentially hazardous changes, and human activities are largely responsible. The scientific community has reached a strong consensus that greenhouse gases are accumulating in our atmosphere, causing surface air and subsurface ocean temperatures to rise. Continuing historical trends will result in additional warming over the 21st century: current projections are of a global increase of 1.4°C (2.5°F) to 5.8°C (10.4°F) by 2100. In addition, increases in sea level and changes in precipitation, including more frequent floods and droughts, are likely.

Our energy sources and capital equipment must look very different by the middle of this century if we are to avoid the most severe consequences. How will we power our economy? How will developing and industrialized countries alike achieve reductions in their greenhouse gas emissions while meeting their goals for growth? At a more everyday level, how will we get to work? What kind of office buildings will we work in? What kind of cars and trucks will we drive?



Some positive actions are being taken. Many countries are moving toward ratification of the Kyoto Protocol, and several programmes to trade greenhouse gas emissions are being developed. The UK Emissions Trading Scheme (ETS) – a national system to reduce emissions and allow for them to be traded – officially began in April 2002, while the European Union has developed a carbon dioxide (CO_2) emissions trading system. Despite the Bush Administration's rejection of the Protocol in the United States, there is legislative activity in the US Congress and in the states aimed at reducing emissions. For example, Senators John McCain (Republican, Arizona) and Joseph Lieberman (Democrat, Connecticut) have introduced legislation that would establish an economy-wide greenhouse gas emissions trading programme. The bill is not likely to be enacted soon, but it has helped spark a long-overdue debate on just how the United States will live up to its obligations as the world's largest emitter of greenhouse gases.

Business interest

An increasing number of leading companies, including members of the Pew Center's Business Environmental Leadership Council (BELC), see a clear business interest both in reducing their greenhouse gas emissions and in helping to shape a climate-friendly future. The BELC's 38 members represent nearly 2.5 million employees and have combined revenues of $855 billion. They have diverse strategies for reducing emissions. Alcoa, which operates in more than 40 countries, for example, is developing a new technology for smelting aluminium that, if successful, will allow the company to reduce its emissions to half 1990 levels over the next nine years.

Nevertheless, not nearly enough is happening. We must combine a long-term vision of a climate-friendly future with

Our energy sources must look very different by the middle of this century if we are to avoid the most severe consequences

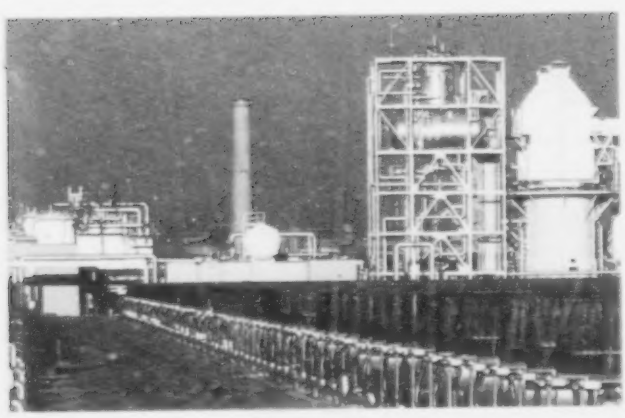
the short-term strategies that will get us there. We must ultimately dramatically reduce emissions of CO_2 and other greenhouse gases to protect ourselves, the global economy and the environment. We must fundamentally transform the way we power our global economy, shifting away from a legacy of fossil fuel use in pursuit of more efficient and renewable sources of energy. Society will have to engage in a concerted effort, over both the near and the long term, to seek out opportunities and design actions to reduce greenhouse gas emissions.

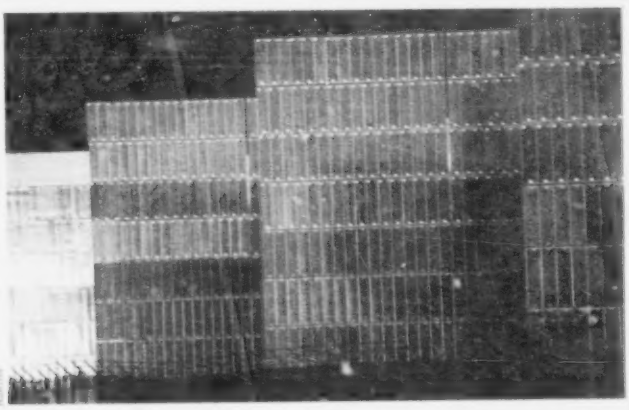
Starting now

In particular, we must determine how to meet the growing demand for electricity. No simple solution is on the horizon. We can expect a future with greater use of natural gas (if we can increase supply and meet infrastructure needs); with a steadily increasing use of renewables (and the progress of wind energy over the last decade should give us a glimmer of hope); with increased emphasis on distributed generation and combined heat and power; with nuclear at least maintaining its current share of the market; and finally with coal, if we are able to master carbon capture and sequestration and make it economically viable.

We must start now to identify the steps needed for the transition to a new, climate-friendly global economy. There are short-term strategies that could significantly reduce greenhouse gas emissions without radical changes in technologies or lifestyles. Efficiency improvements, for example, can both save money and reduce emissions. In the longer term, we cannot achieve our vision for the future – or even take advantage of the myriad of shorter-term improvements that are environmentally and economically advantageous – without strong greenhouse gas reduction policies. These could include:

- Mandatory reporting and disclosure of greenhouse gas emissions – from major sources, at the very least – where companies now acting to reduce their emissions are assured of credit under future mandatory regimes.
- A combination of financial incentives, technology standards, and other policies and programmes to expand the use of renewable energy, alternative fuels and technologies – and energy-efficient motor vehicles, appliances and buildings.
- The expansion of natural gas supply and infrastructure and the promotion of advanced coal technologies with carbon capture and disposal.
- Programmes to reduce greenhouse gas emissions coupled with flexible, market-based mechanisms such as emissions trading.





We must start now to identify the steps needed for the transition to a new, climate-friendly global economy

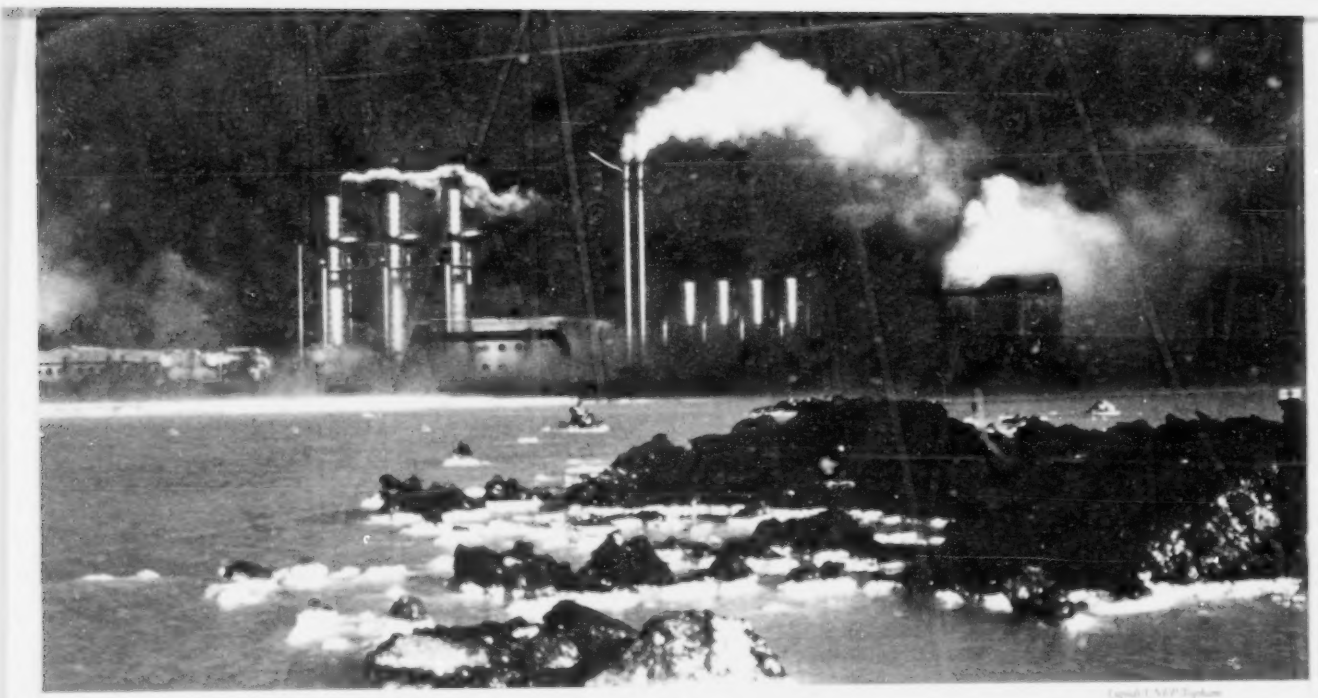
With more than 100 countries now committed to the Kyoto Protocol, this landmark agreement may soon enter into force. If so, its launch will send a strong signal to markets that emissions of greenhouse gases come with costs; it will be a declaration of multilateral will to confront a quintessentially global challenge. But it will be only a first step. With the United States not joining, the Protocol will cover just 40 per cent of global emissions, and only for the next decade.

Beyond Kyoto

Whether or not the Protocol comes into force, the challenge will remain the same: engaging all the world's major emitters in a longer-term effort that fairly and effectively mobilizes the resources and technology needed to protect the global climate. An agreement that is going to work – that can bring in not only the United States, but developing countries as well – will in all likelihood be something other than Kyoto. Achieving it will take time.

The more immediate challenge, though, is in the United States. The longer US policy makers wait to address the climate issue seriously, the greater the risk to the climate and to the country's standing in the world. In the long run, we can only address climate change by drastically reducing our emissions from the use of fossil fuels. If it is to be effective, our response to the challenge must begin now ■

Eileen Claussen is President of the Pew Center on Global Climate Change.



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BREAKING *the* ICE

Maria Maack describes the first steps Iceland is taking towards a hydrogen economy

'Life is fish' goes a popular saying in Iceland. But without oil there might be no fish either. Our country's main foreign income comes from exporting fish, and the fishing fleet runs on oil.

People around the world recognize the economic vulnerability linked to the dominant use of a few types of fuel delivered from a handful of producers. But probably no countries are more vulnerable to energy deficiency than islands, which cannot expect to borrow electric current from their neighbours.

Our volcanic island, not connected to larger continental energy grids, is particularly vulnerable to developments in the oil business. It has no carbon sources, no fossilized deposits, and no biomass in large enough quantities — though there are abundant geothermal and hydropower sources, as well as strong winds, marine currents, high waves and tides.

Iceland is now taking a new initiative, involving hydrogen made by electrolysis from water using renewable energy, which could demonstrate the performance of elements that might be applicable in energy systems even in very different situations.

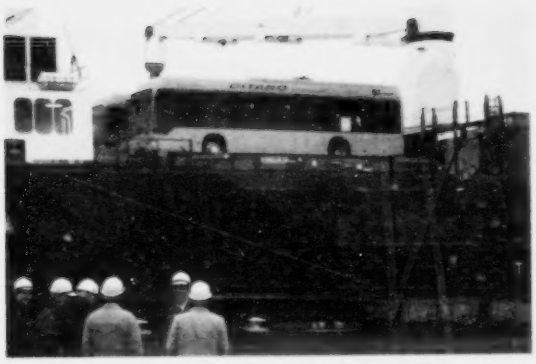
During the 1970s oil crisis, Bragi Arnason, a professor of chemistry at the University of Iceland, pointed out that it should be possible to produce hydrogen from freshwater, using hydropower to generate the needed electricity. This would then be used to run transport on land and the fishing fleet. His ideas were noticed, but not implemented. Yet Professor Arnason continued to introduce his students to this idea, to calculate the best production options and demonstrate ideas for small power plants servicing different regions of the country with hydrogen.

Rare opportunity

From the 1970s to the 1990s, the country's hot springs were exploited on a vast scale and piped and distributed for domestic heating and to some industries. The first geothermal electric power plant was erected at Krafla, a huge investment which brought more knowledge than power in the first stages. Even small communities and isolated farms were connected to the national grid and heated by local hot springs. These developments gave a rare opportunity to experiment with renewable energy, energy efficiency and new technologies adapted to local situations. Icelandic technicians learned much by executing such large 'hands on' experiments, an experience that is now a unique asset. In Iceland heating is provided almost exclusively from sustainably managed geothermal sources and electricity from hydropower plants. Oil is only used for transport and the fishing fleet, amounting to about 30 per cent of the total energy use. If hydrogen, a local fuel made from local renewable sources, could be used as a substitute for it, then the whole energy economy could become self-providing.

In 1999 Icelandic New Energy, a joint venture private company, was founded by the most important energy companies, local investment funds and research institutes. Its mission is to test hydrogen as an energy carrier like oil. It also draws support from other shareholders — Norsk Hydro, Shell Hydrogen, DaimlerChrysler — which want to test their technological developments and extrapolate the results to an image of a society run on hydrogen. In addition, the European Commission is supporting the first projects.

Last April the first hydrogen fuel station was inaugurated on the outskirts of



Reykjavik, complete with see-through panels displaying explanations for the public. In October, three hydrogen fuel-cell buses started their daily route between the city centre and the eastern suburbs. Their inauguration was celebrated at a public festival where families could ride in the buses and take a close look at the fuel station.

In 2003, three hydrogen fuel-cell buses began running between Reykjavik city centre and the eastern suburbs

Harsh test

The test is expected to be harsh. Winter winds carry salt from the sea. Temperatures easily vary between -10 and +10°C in the same day. Driving conditions include snow cover, icy roads, wet highways and even some un-asphalted gravel strips. Early morning darkness gives way to dusk at noon, and the buses' exhaust steam may freeze rapidly.

During this test period the Icelandic Technical Institute will measure the composition of the emissions from the fuel-cell buses and compare it with those of similar diesel-driven buses on the same route. Life cycle analyses will compare all aspects of both types of fuel and bus. And passengers, conductors, the maintenance team and the general public will be asked about their attitudes towards energy issues and the testing of hydrogen technology. Some people associate hydrogen with explosions or accidents, but in Iceland the general attitude is positive.

In September, Icelandic New Energy donated educational material on multi-media CDs – supported by private businesses and the European Commission – to all colleges in Iceland. During the summer the first international PhD course on hydrogen infrastructure was held in Reykjavik, supported by the Nordic Research Fund.

Iceland's hydrogen initiatives have met respect from abroad. There is a surge of interest in the possibilities of using hydrogen as an energy carrier.

The hydrogen economy will need to compete with an already well-established fuel industry that has had 100 years to settle in. Hydrogen has been widely used in industry for a long time, for example in oil refineries and food processing. But because of accidents involving (although not caused by) large quantities of the gas in the past, the new hydrogen fuel technology has to follow extremely strict security procedures and safety protocols.

Pricing right

As long as the costs of such external factors are applied only to hydrogen, establishing it in the competitive fuel market will be tough. But if all nations were to accept the external costs of using fossil fuels – such as damage from air pollution and climate change – and price oil and coal accordingly, this would favour the use of electricity from renewable energy, cleaner fuels and higher efficiency within the current system.

It is here hydrogen is competitive. It does not release particles that cause asthma and lung disease or emit greenhouse gases. It does not pollute historical and cultural monuments with soot. It does not spoil groundwater or cling to clothes or car interiors.

Dr Joan Ogden and her colleagues at Princeton University have shown through comparative examples that if health care costs, the cost of climate change and the cost of securing supplies of fossil fuels are incorporated in the life cycle cost of typical vehicles, then continuing with our petrol-powered cars is the most expensive way to run our transport systems. By contrast, with the cost reductions brought by moderate mass production, the vehicles using fuel cells and hydrogen from renewable sources pose the lowest foreseen life cycle costs.

Transporting hydrogen gas can be bulky and therefore local production and minimal distribution is probably a good option. But a hydrogen economy would simply be the next step in Iceland's continuous story of securing self-reliance and high living standards ■

Maria Maack is Environmental Manager of Icelandic New Energy.

In my lifetime *100% renewable*

Amaidhi Devaraj

Thanks to our geography and our vast coastline, there is tremendous potential for generating renewable energy in India.

Young people can and do make significant contributions to harnessing it. An engineering student in Pune recently invented a device that generated electricity through the movement of vehicles over a pressure-spring system. The vehicles pass over what looks like a speed breaker and the constant up and down motion of the spring below creates the movement necessary to generate electricity through magnetic induction.

A pilot 'speed breaker' will soon be installed in the busy City Market area of Bangalore, where the idea was further researched and developed. There are 11 million vehicles in Bangalore, and it is estimated that the energy that they could generate in one day would be enough to keep a football stadium's lights burning for a whole week.

Other simpler forms of youth action in India include setting up internet chat rooms and interest groups. These often get together to discuss ways of petitioning local and national governments to do more to harvest renewable energy.

I have also been working with a group of other young people to research the science of creating a green automobile fuel from sugar cane molasses.

But India remains a land of villages. Rural people largely depend upon fuelwood, crop residues and cow dung to meet their basic energy needs for cooking and heating. With the increasing population pressure of around a billion people, the consumption of fuelwood has far exceeded its sustainable supply, causing deforestation and desertification. The desertification of the land around the Bandipur forests near my home in South India results from this overwhelming dependence on fuelwood by poor landless peasants and tribal people. In my lifetime, it has turned pristine verdant forests into arid wastelands.

The age-old practice of burning cattle dung and crop residues for cooking is similarly destructive. It deprives agricultural land of much needed manure, depleting soil fertility. Inefficient burning of cow dung in traditional stoves creates a lot of smoke in small village huts without effective ventilation, causing breathing difficulties and sight problems for many rural women and children. The Government's strategy has been to promote biogas units for recycling cow dung to harness its value for fuel without destroying the value of the manure. Lavatory-linked biogas plants that both treat human waste and provide much needed methane fuel for cooking are also popular. Both need much more promotion and tax breaks to ensure widespread implementation. The air in Delhi and other cities has been noticeably cleaned up by converting the city buses and auto-ricks from diesel to gas power so people, and especially young people, are ready for more policy initiatives like this.

India has made great strides in the direction of harnessing renewable energy through biogas, biomass, solar energy, wind energy, small hydropower and other emerging technologies. The Government has devised a scheme to give concessions on their monthly electricity bill to people who install solar water heaters. We need more of this. I hope that, in my lifetime, India will become 100 per cent powered by renewable energy, over which we have complete control, so future generations will no longer be dependent on polluting fossil fuel supplies, over which we have none ■

Amaidhi Devaraj is studying Law at the University of Bangalore, South India.